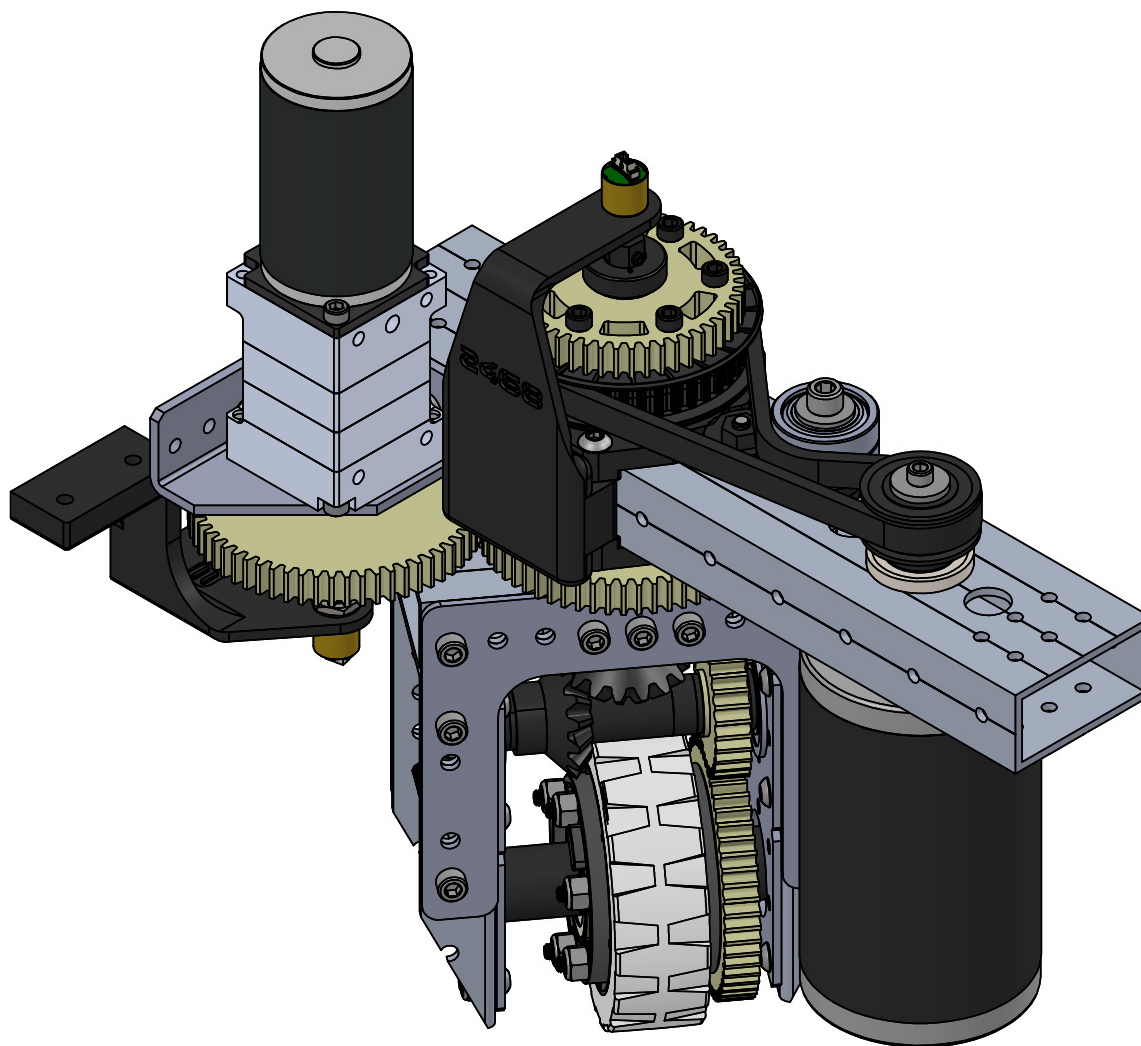
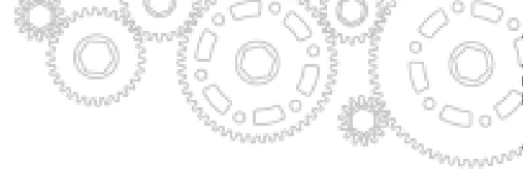


VersaSwerve Drive System





VersaSwerve Drive System

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FRC TEAM 2468

The VersaSwerve Drive System was developed by a team of students from FRC Team 2468, Team Appreciate, with support from VEX Robotics in the form of design reviews and sponsorship of VEX products for testing. The documentation of the development process is uploaded on www.FRC2468.org

Purpose

To develop a swerve drive system that employs VEX products for lower resource teams and serve as an example for teams to develop their own systems using VEX products. To achieve this, the development team focused on four main qualities.

- The swerve will be built primarily from VEX parts to promote ease of machining. If a part must be machined, it will be manufacturable using a bandsaw, a drill press, a mill, a 3D printer, a brake, or a lathe.
- The swerve must also be easy to assemble and mount. Teams should be able to achieve these with simple hand tools that are common in FRC competition pits.
- The swerve modules should cost as little as possible to allow all teams to build the system for their robot.
- The modules will have integrated absolute encoder mounts for easy programming and control of the drive system

VersaSwerve Drive System

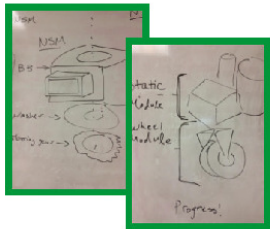
Development of the VersaSwerve Design

Research



All projects at FRC Team 2468 begin with extensive research. The first assignment given to the VersaSwerve team members was researching and learning about what swerve designs had been developed in the past by other FRC teams. This helped make sure everyone understood the basic components and functionalities of swerve drive systems as well as set goals for the final product.

Brainstorming



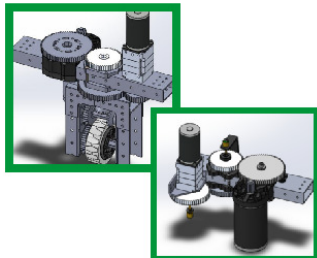
The entire development team met for a thorough brainstorming phase to begin the development of the actual design. By utilizing information found from the research stage, the team came to a consensus on the overall shape of the swerve module and created a rough CAD model of the system.

Initial Design Review



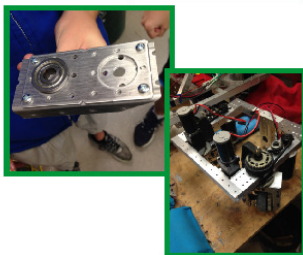
The development team held a videochat meeting with a VEX engineer to report the progress of the team and get feedback on the overall ideas behind the design. The feedback was recorded and discussed by the team to come to a consensus on the direction of the design.

Iterative CAD Development



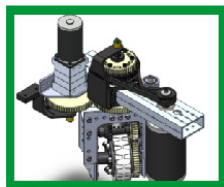
The development team assigned sub-systems to specific students and began working on refining the design. This was the longest stage of the development cycle and several design reviews were held before the design was matured for testing.

Manufacturing and Testing

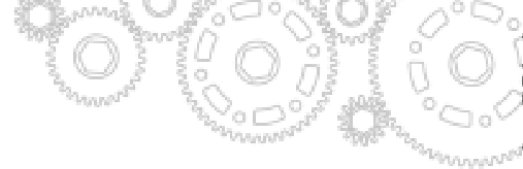


The design was approved by VEX robotics in a critical design review, and parts were ordered for manufacturing. By manufacturing the actual system, the team was able to further refine the design for easier manufacturing. After two modules were assembled, they were attached to each other to form a test rig for programming. This test rig also allowed the development team to test the rigidity of the design.

Final Design



Several design changes were made in accordance with the results from testing and the final design was published.



VersaSwerve Drive System

Manufacturing Requirements

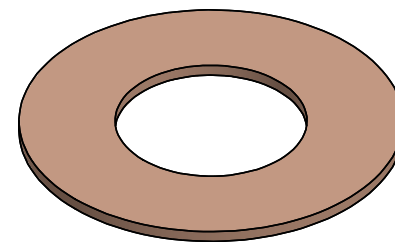
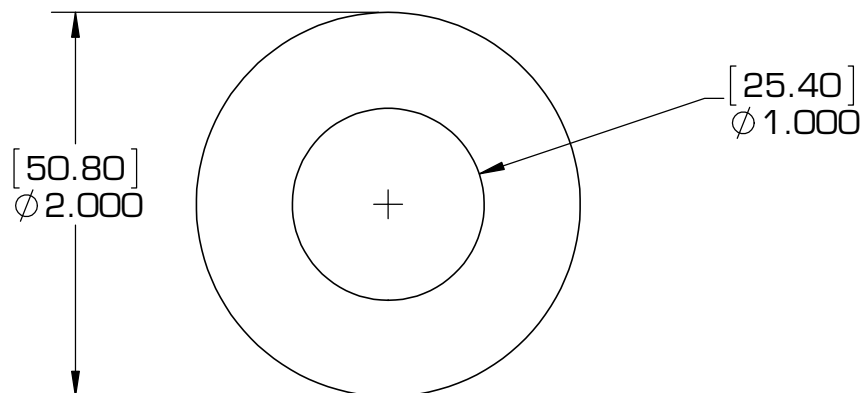
The VersaSwerve was developed with teams' machining capabilities in mind. All of the components are able to be machined using only basic shop tools: a bandsaw, a chop saw, a drill press, a manual mill, and a lathe with appropriate tooling. The encoder mounts are 3D-printable.

Bill of Materials

ITEM NO.	DESCRIPTION	PART NUMBER	QTY.
1	Wheel Module - Side C-Channel	From 217-4108	2
2	Wheel Module - Top 1x2in Channel	From 217-3453	1
3	Wheel Module - Wheel Axle	From 217-4017	1
4	Wheel Module - Transfer Shaft	From 217-2754	1
5	Wheel Module - Input Shaft	From 217-2754	1
6	Static Module - Cutdown Corner Gusset	From 217-4238	1
7	Static Module - Housing 1x2in Channel	From 217-3453	1
8	Static Module - Tensioner Standoff	From 217-2762	1
9	VersaWheel DT (3.25")	217-3202	1
10	15t Bevel Gear with 3/8" Hex Bore	217-3344	2
11	30t Gear with 3/8" Hex Bore	217-3210	1
12	48t Gear with 3/8" Hex & VersaKeys	217-3217	1
13	54t Gear with 1.125" Bearing Bore & VersaKeys	217-3339	1
14	60t Gear with 1.125" Bearing Bore & VersaKeys	217-3342	1
15	60t Gear with 1/2" Hex Bore	217-3574	1
16	VersaPulley Kit (HTD 5mm) - 42T, 18mm wide	217-3199	1
17	Timing Pulley (HTD 5mm) - 18T, 9mm Double Flange	217-3225	1
18	Timing Belt (HTD 5mm) - 80T, 9mm Wide	217-3456	1
19	Base VersaPlanetary 1:1 <with Cutdown 1/2" Hex Output>	From 217-3563	1
20	VersaPlanetary 10:1 Gear Kit with Ring Gear	217-3570	2
21	VersaFrame Face Bearing Mount	217-4183	2
22	Flanged Bearing - 0.375in (Hex) x 1.125in x 0.313in	217-2735	5
23	Flanged Bearing - 0.500in (Hex) x 1.125in x 0.313in v2	217-3875	3
24	Radial Bearing - 0.500in x 1.125in x 0.313in	217-3109	2
25	1/16" Acetal Spacer - 3/8" Hex	217-3258	3
26	1/8" Acetal Spacer - 3/8" Hex	217-3256	1
27	1/4" Acetal Spacer - 3/8" Hex	217-3260	1
28	1" Acetal Spacer - 3/8" Hex	217-3443	1
29	1/16" Acetal Spacer - 1/2" Hex	217-3257	2
30	1/8" Acetal Spacer - 1/2" Hex	217-2758	1
31	1/4" Acetal Spacer - 1/2" Hex	217-3259	5

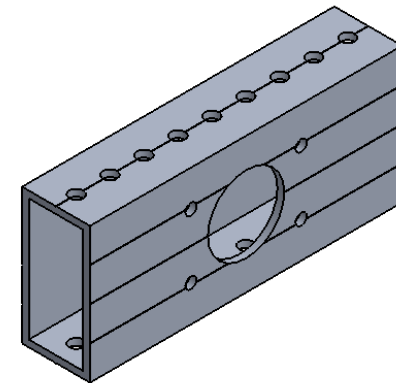
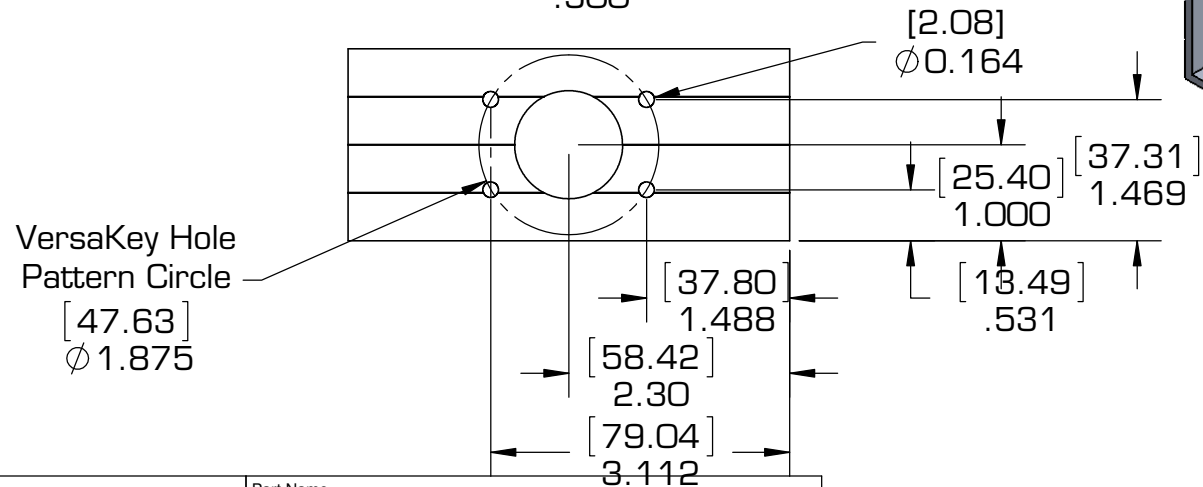
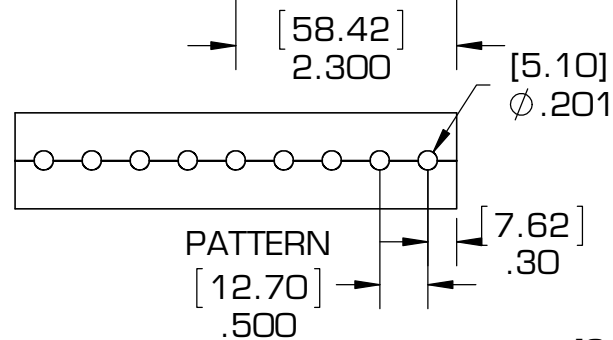
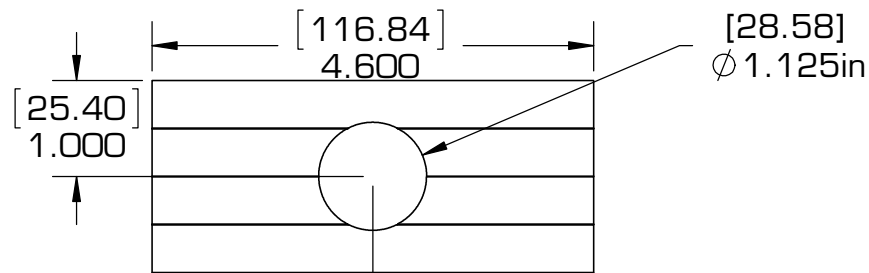
VersaSwerve Drive System

ITEM NO.	DESCRIPTION	PART NUMBER	QTY.
32	1" Acetal Spacer - 1/2" Hex	217-3263	1
33	Clamping Shaft Collar - 3/8" Hex ID	217-2739	1
34	CIM Motor with Cutdown Shaft	From 217-2000	1
35	BAG Motor	217-3351	1
36	VersaBlock Kit	217-3432	1
37	WCP Cam	217-3431	1
38	Static Module - Long 8mm to 1/2" Hex Adapter	From 217-3255	1
39	Static Module - Cutdown 8mm to 1/2" Hex Adapter	From 217-3255	1
40	Wheel Module - Thin Thrust Bearing	From 7814K36	1
41	Multipurpose 2" OD, 1" ID, 1/8" Thick Thrust Bearing	7814K36	1
42	Wheel Module - Support Block	From 8975K237	1
43	Wheel Module - Shaft Stopper Pin	From 98381A420	1
44	Wheel Module - Support Tube	From 9056K36	1
45	Static Module - Support Bushing	From 6381K18	1
46	Static Module - Drive InnerShaft	From 1439K211	1
47	Static Module - 2mm Key	From 92288A710	1
48	Set Screw, #6-32 x 0.1875 Long	92313A143	3
49	Button Head Screw, #8-32 x 0.4375 Long	91255A164	12
50	Socket Head Screw, #8-32 x 0.500 Long	91251A194	1
51	Socket Head Screw, #8-32 x 0.5625 Long	91251A280	5
52	Socket Head Screw, #8-32 x 1.000 Long	91251A199	6
53	Socket Head Screw, #8-32 x 1.875 Long	91251A188	6
54	Button Head Screw, #10-32 x 0.625 Long	91255A267	2
55	Socket Head Screw, #10-32 x 0.625 Long	91251A344	2
56	Socket Head Screw, #10-32 x 0.750 Long	91251A345	2
57	Button Head Screw, #10-32 x 1.500 Long Full Thread	91306A277	1
58	Socket Head Screw, #10-32 x 1.500 Long	90044A118	1
59	Socket Head Screw, #10-32 x 2.500 Long	91251A355	8
60	Socket Head Screw, 1/4-20 x 0.500 Long	91251A537	2
61	Socket Head Screw, 1/4-20 x 2.500 Long	91251A552	1
62	Socket Head Screw, 5/16-18 x 0.500 Long	91251A578	2
63	Nut, Nylock #8-32	90631A009	24
64	Nut, Nylock #10-32	90631A411	8
65	Nut, Nylock 1/4-20	97135A210	1
66	Washer, Oversized #8	90377A118	1
67	Washer, 1/4	96765A140	4
68	Washer, 5/16	96765A145	2
69	Retaining Ring (E-Style), 0.500 Shaft Size	97431A340	1
70	Wheel Module - Custom U-Gusset	0.090" Thick Sheet Metal	2
71	MA3 Encoder	MA3-A10-125-N	1
72	MA3 Encoder	MA3-A10-125-B	1
73	Steering Encoder Mount	3D Printed	1
74	Drive Encoder Mount	3D Printed	1
75	Encoder Adapter	3D Printed	1



Part Name	
Wheel Module - Thin Thrust Bearing	
Sub-System/Project	
VersaSwerve - Wheel Module	

Quantity	1
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2468

Part Name

Wheel Module - Top 1x2in Channel

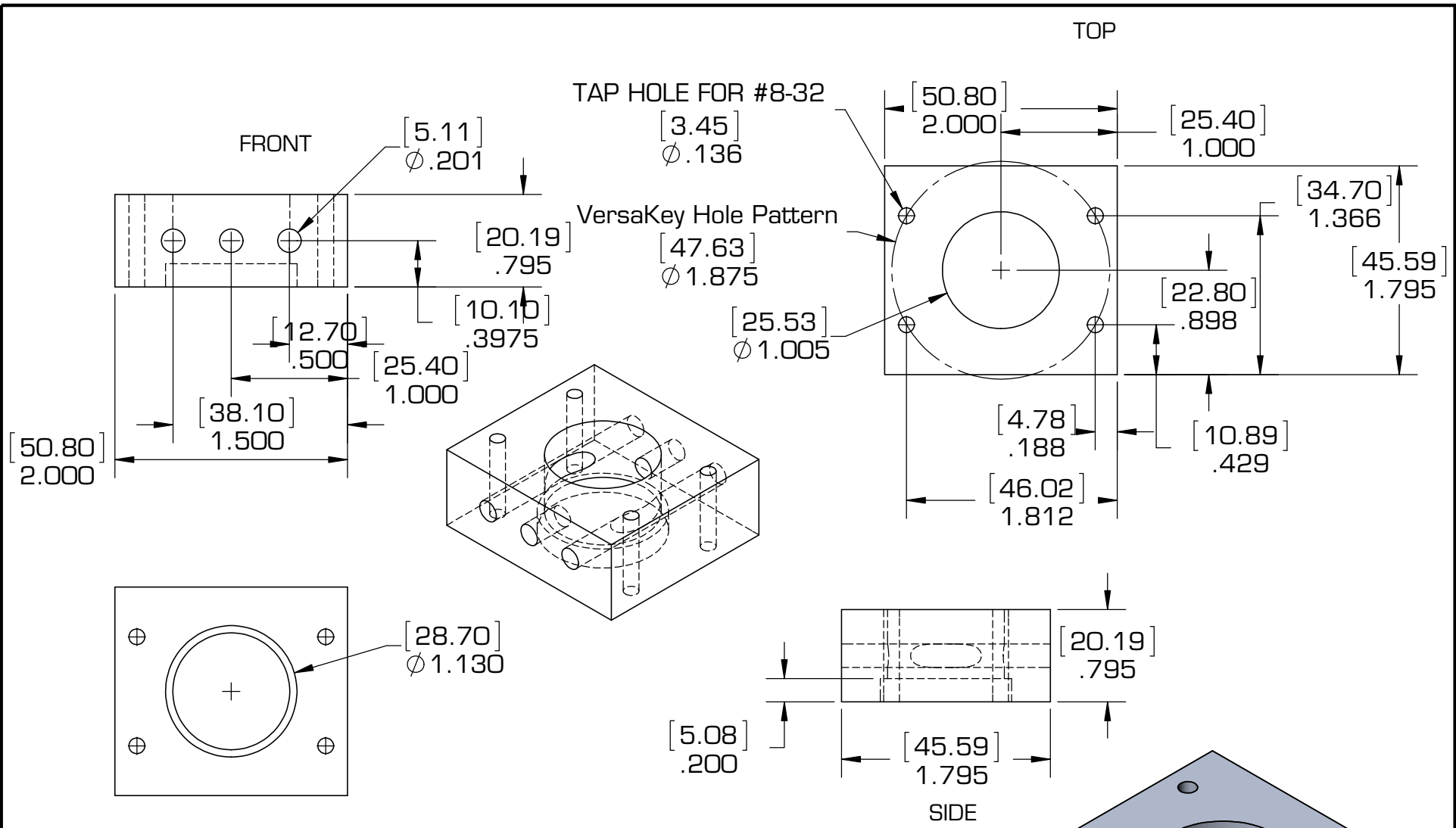
Sub-System/Project

VersaSwerve - Wheel Module

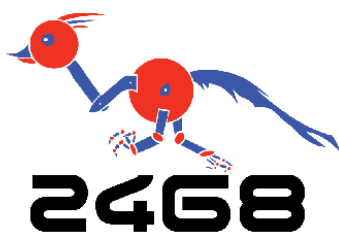
Quantity

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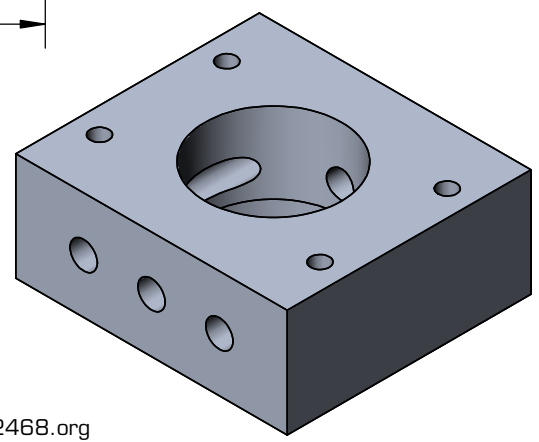
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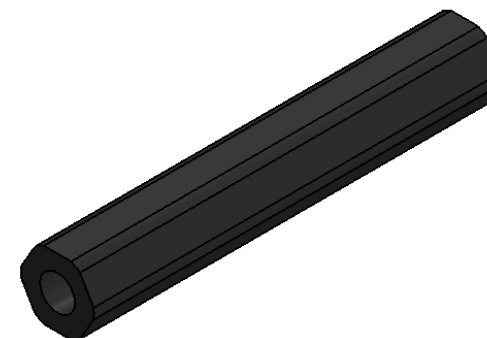
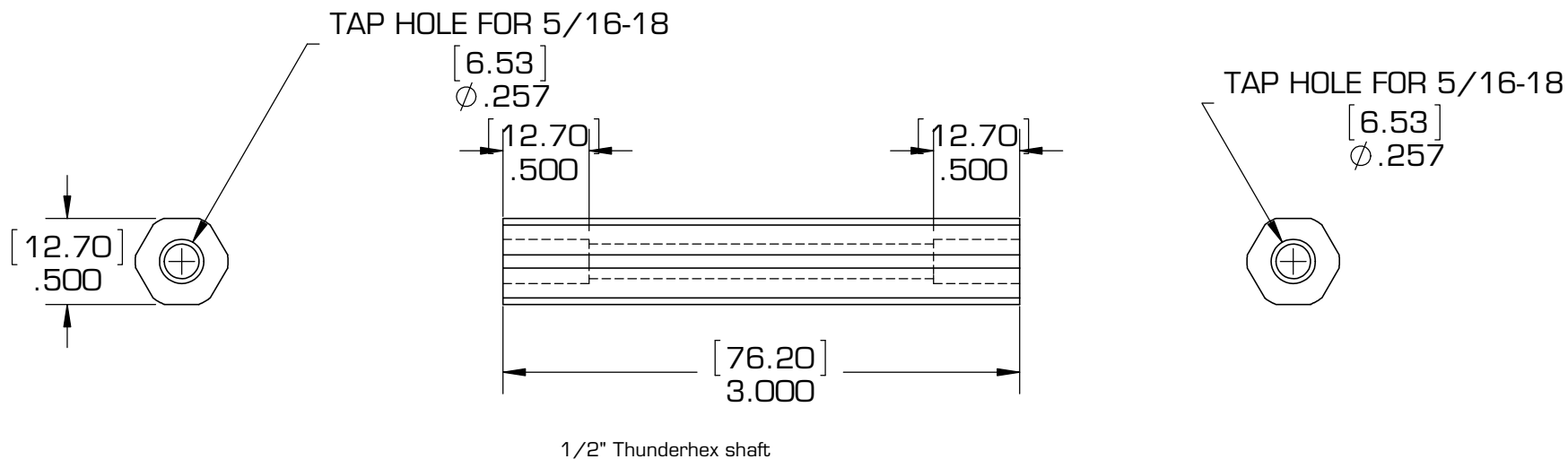
BOTTOM



Part Name	
Wheel Module - Support Block	
Sub-System/Project	
VersaSwerve - Wheel Module	
Quantity	1



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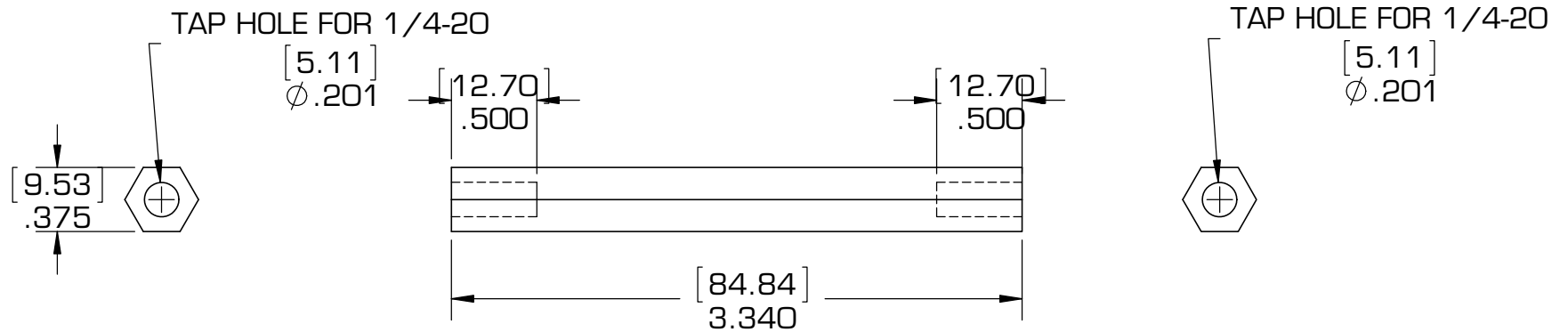


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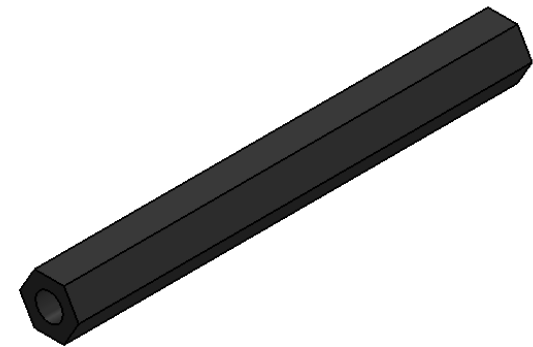
Part Name	
Wheel Module - Wheel Axle	
Sub-System/Project	
VersaSwerve - Wheel Module	
	Quantity

1

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3/8in Hex Shaft



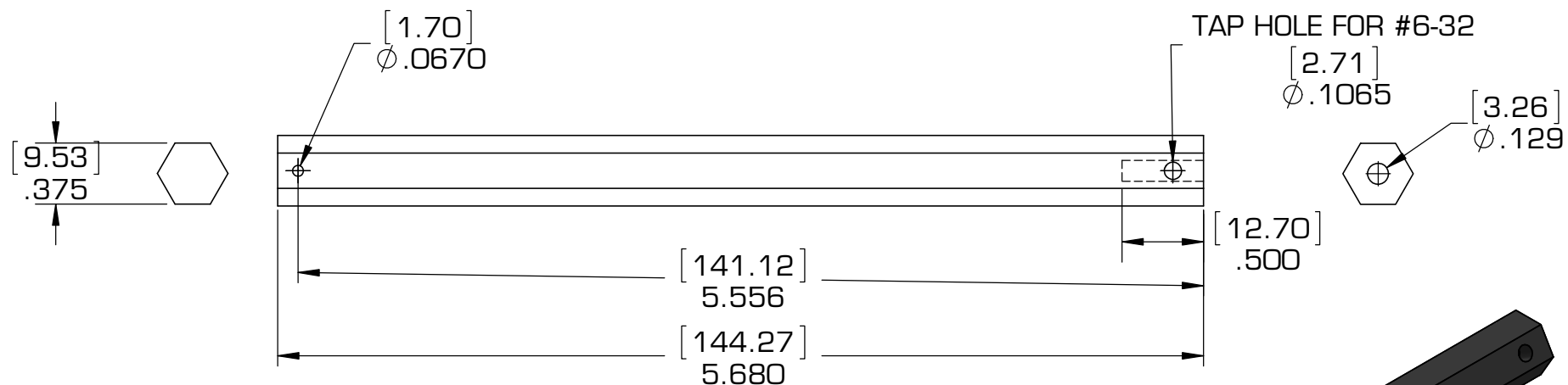
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Part Name	Wheel Module - Transfer Shaft
Sub-System/Project	VersaSwerve - Wheel Module

Quantity

1

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2468

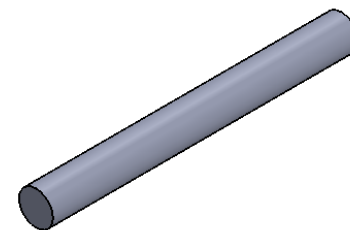
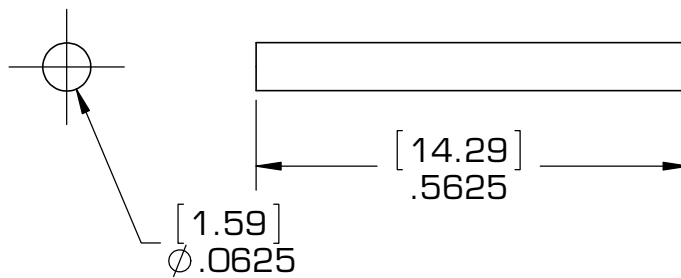
Part Name
Wheel Module - Input Shaft

Sub-System/Project
VersaSwerve - Wheel Module

Quantity

1

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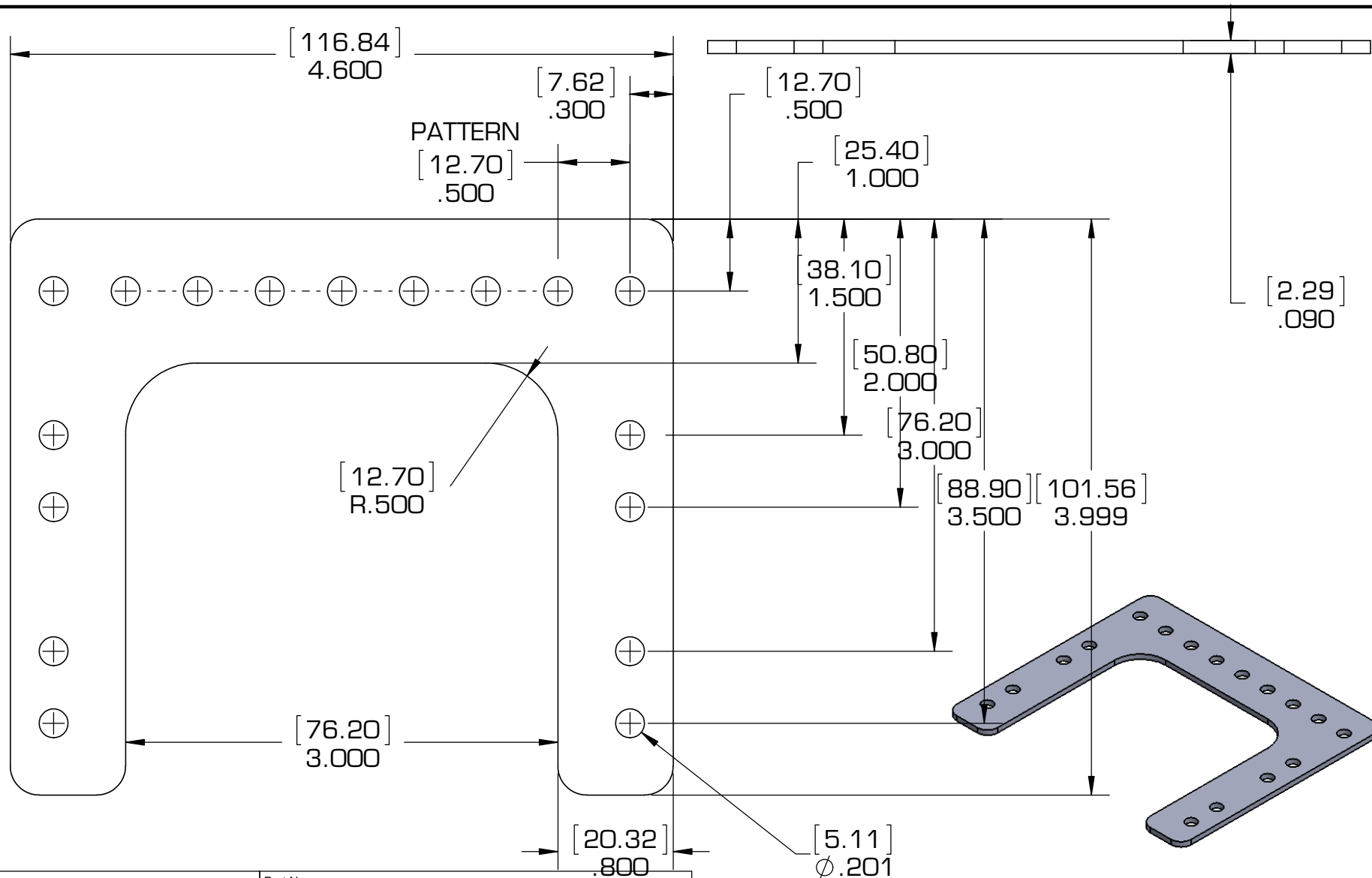


2468

Part Name	
Wheel Module - Shaft Stopper Pin	
Sub-System/Project	
VersaSwerve - Wheel Module	

Quantity	1
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Part Name

Wheel Module - Custom U-Gusset

Sub-System/Project

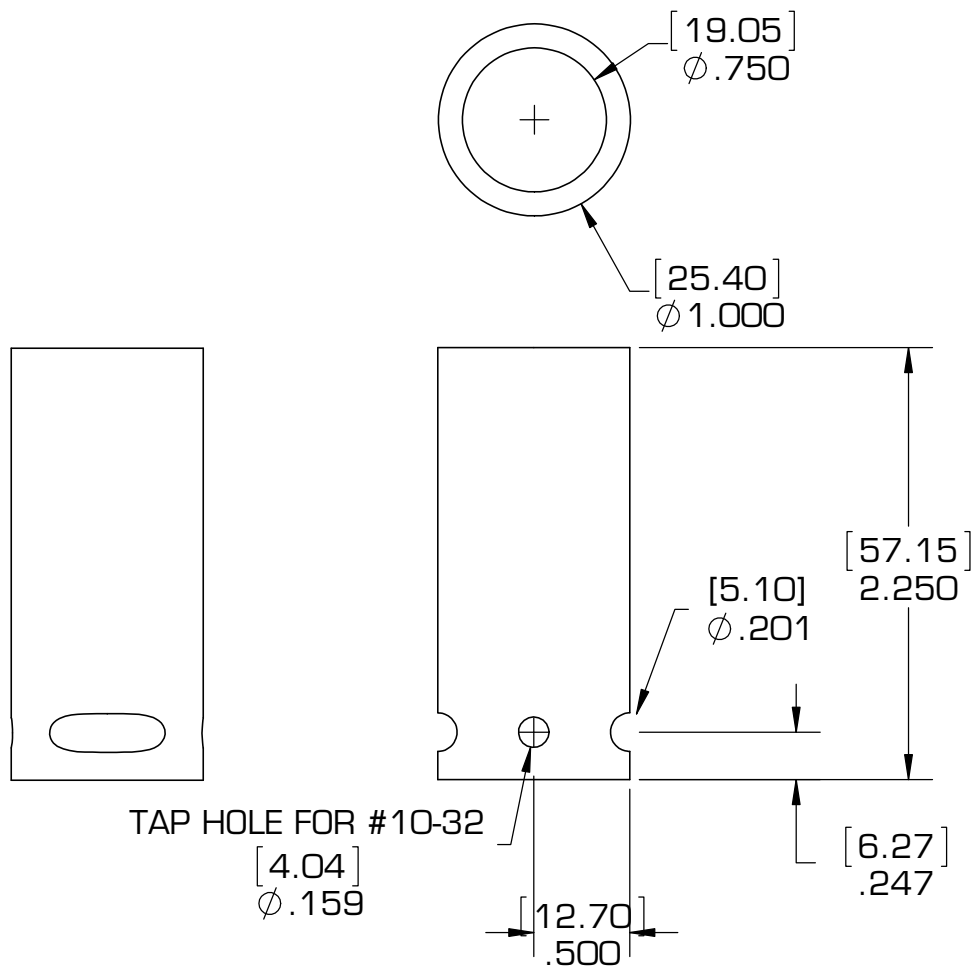
VersaSwerve - Wheel Module

Quantity

2

Print this page and paste the drawing onto a 0.090" thick sheet metal plate. Cut the shape out of the sheet metal using a bandsaw and drill press.

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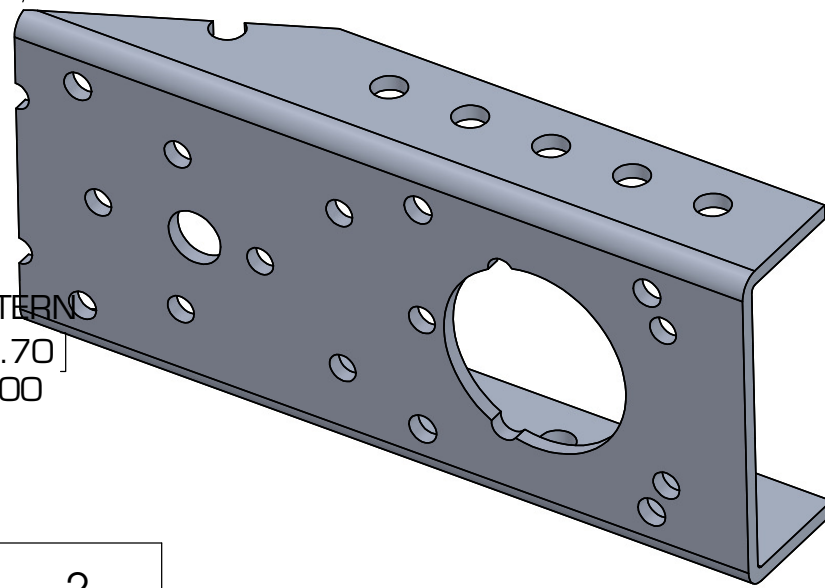


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Part Name	Wheel Module - Support Tube
Sub-System/Project	VersaSwerve - Wheel Module

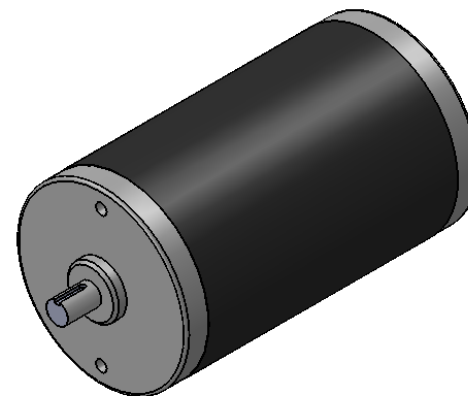
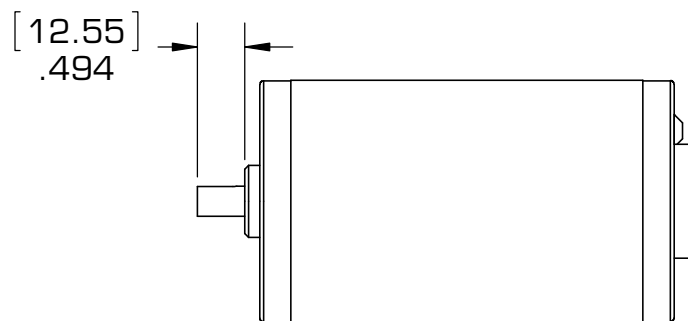
Quantity	1
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2468

Part Name	WheelModule-Side C-Channel	12.70 .500
Sub-System/Project	VersaSwerve-WheelModule	
		Quantity 2

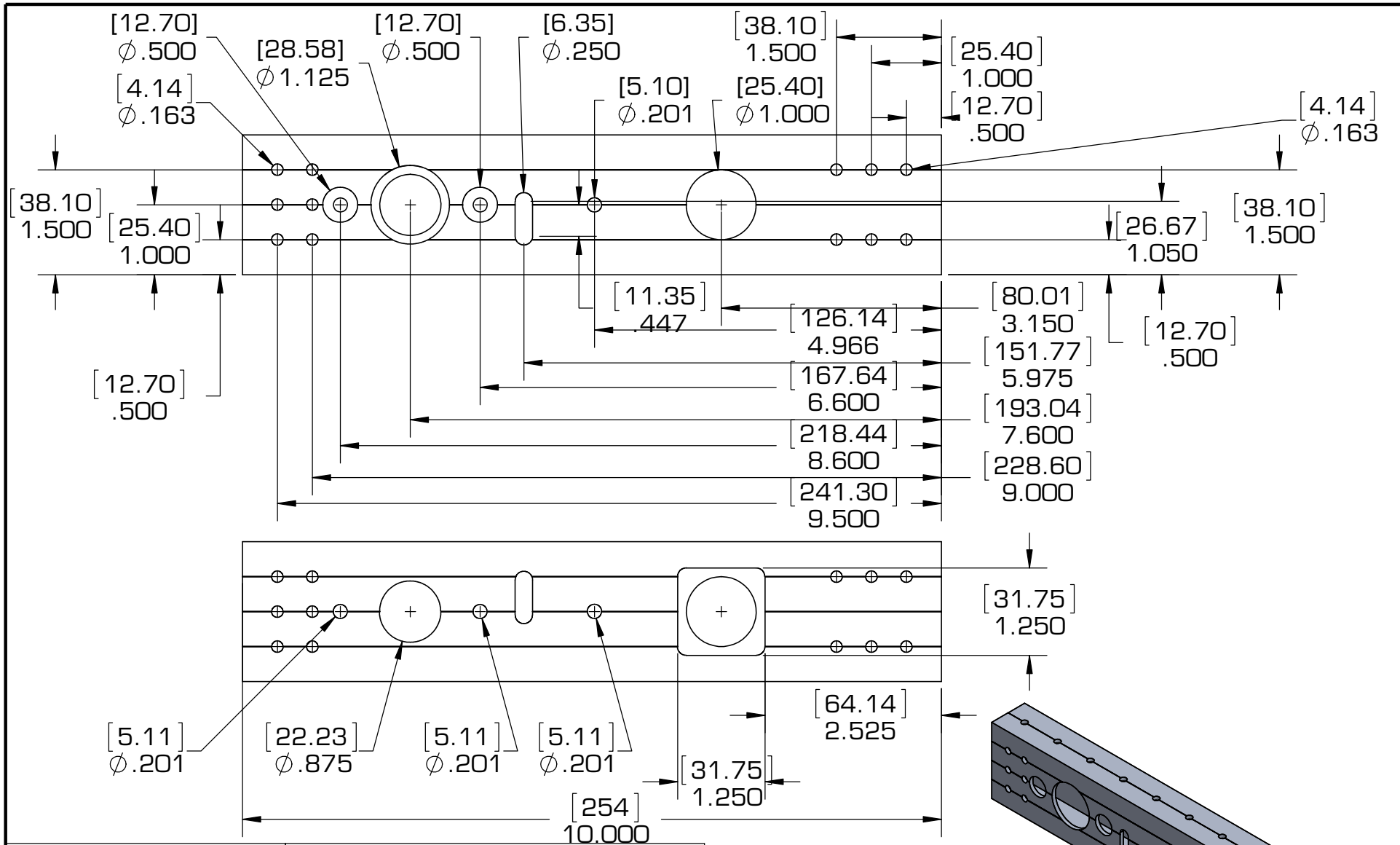


2468

Part Name	
Static Module - CIM Motor with Cutdown Shaft	
Sub-System/Project	
VersaSwerve - Static Module	

Quantity	1
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FRC2468.org



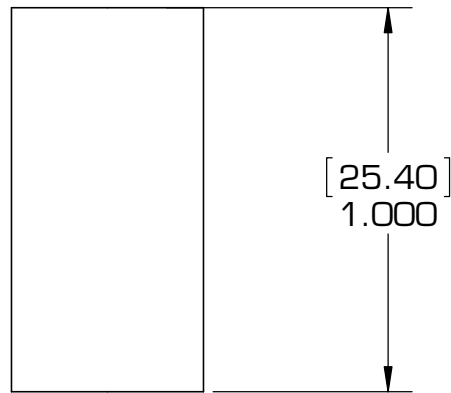
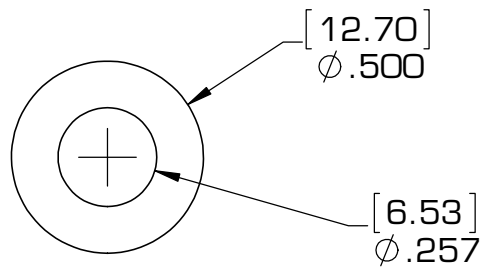
Part Name
Static Module - Housing 1x2in Channel

Sub-System/Project
VersaSwerve - Static Module

Quantity

1

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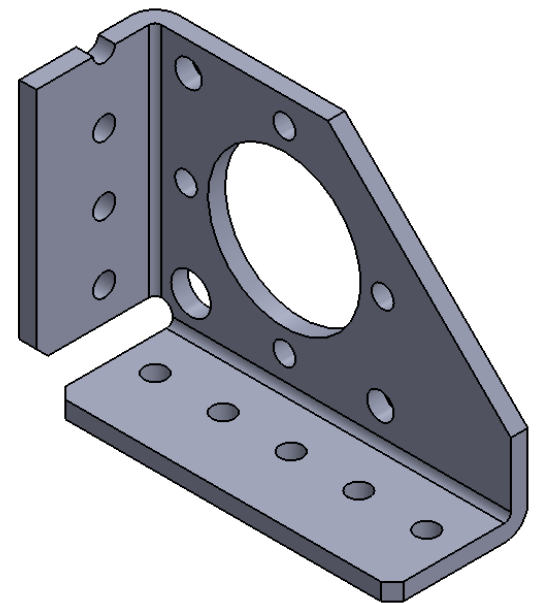
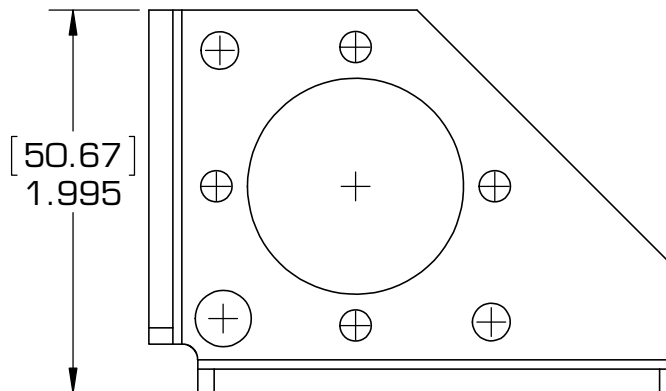
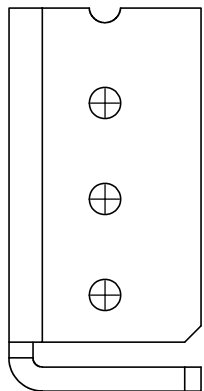


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Part Name	
Static Module - Tensioner Standoff	
Sub-System/Project	
VersaSwerve - Static Module	

Quantity	1
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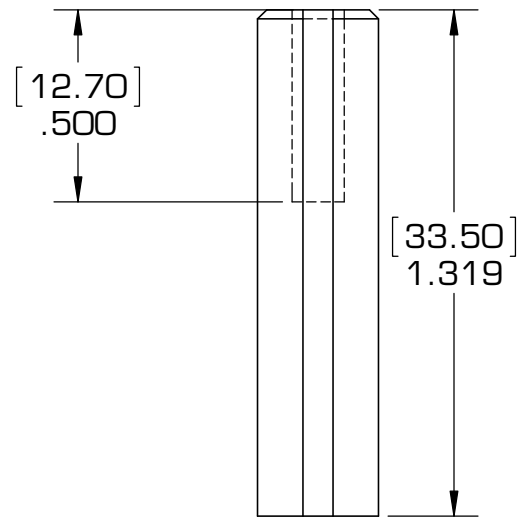
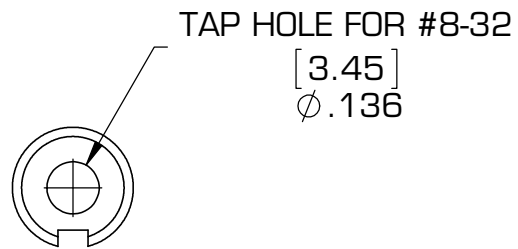
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Part Name	
Static Module - Cutdown Corner Gusset	
Sub-System/Project	
VersaSwerve - Static Module	

Quantity

1

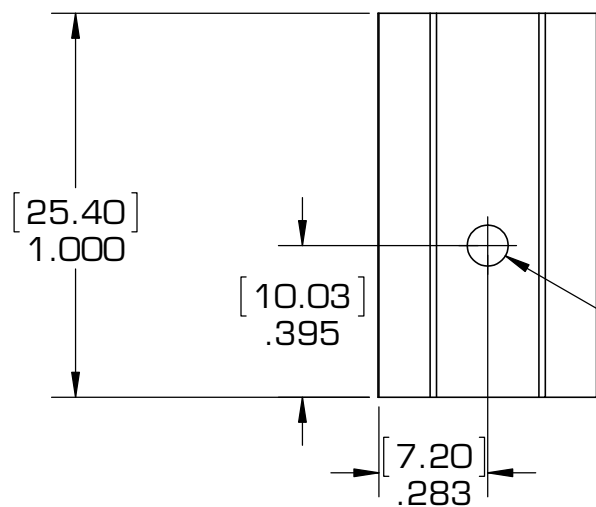
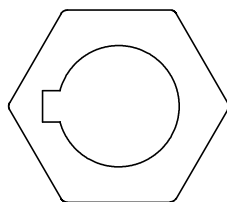
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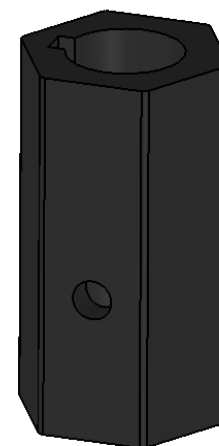
2468

Part Name	Static Module - Drive Inner Shaft
Sub-System/Project	VersaSwerve - Static Module
Quantity	1

FRC2468.org



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2468

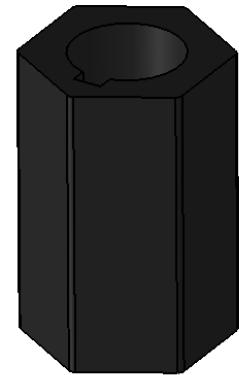
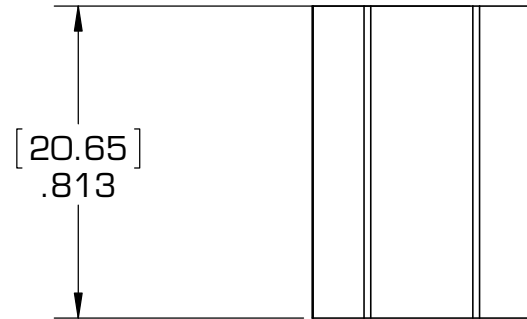
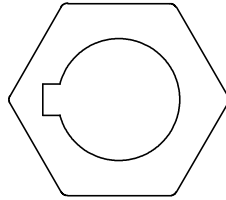
Part Name
 Static Module - Long 8mm to 1/2in
 Hex Adapter

Sub-System/Project
 VersaSwerve - Static Module

Quantity

1

FRC2468.org



2468

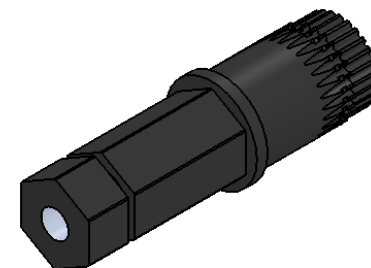
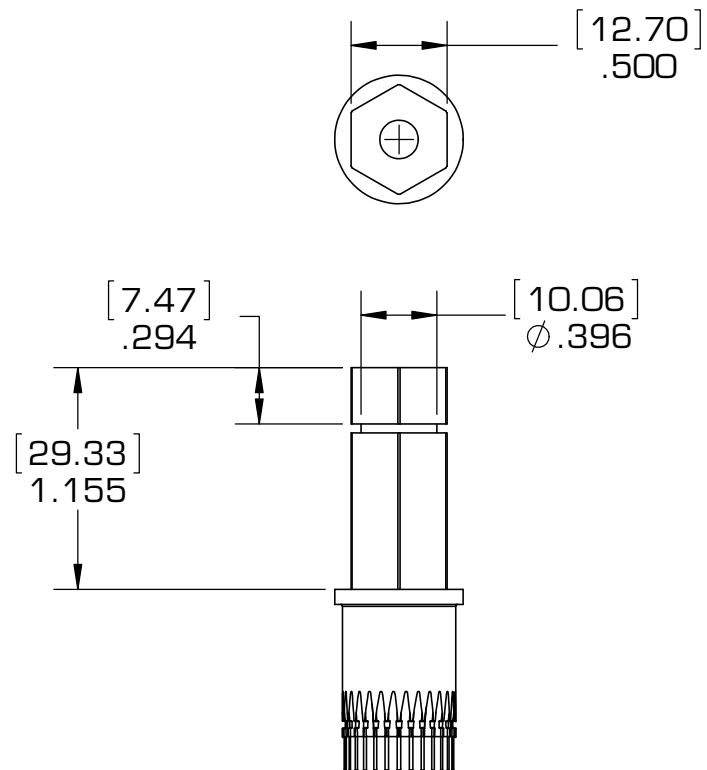
Part Name
Static Module -Cutdown 8mm to 1/2in
Hex Adapter

Sub-System/Project
VersaSwerve - Static Module

Quantity

1

FRC2468.org



2468

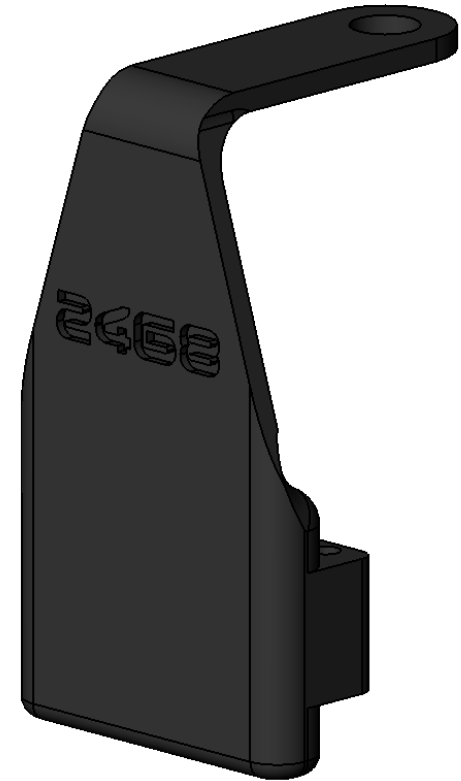
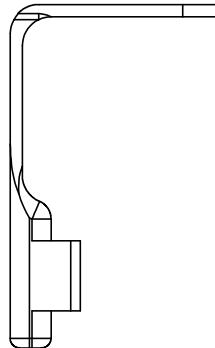
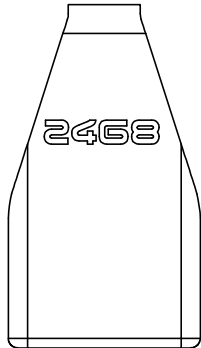
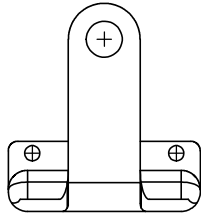
Part Name
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Cutdown 1/2" Hex Output

Sub-System/Project
VersaSwerve - Static Module

Quantity

1

FRC2468.org

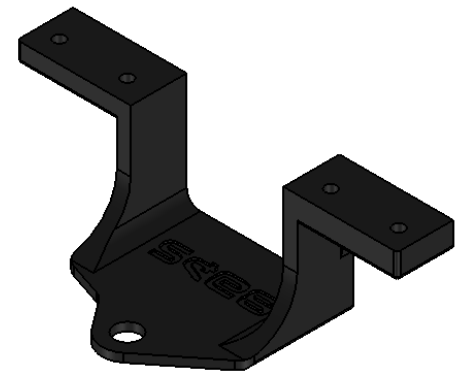
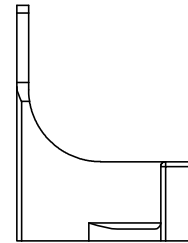
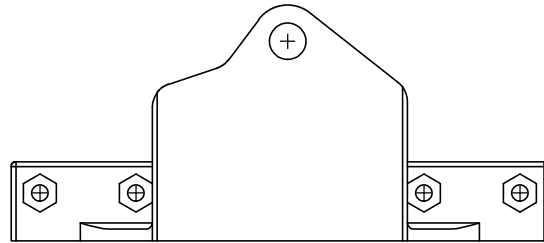
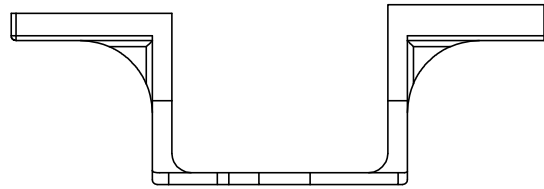


Part Name	
Static Module - Drive Encoder Mount	
Sub-System/Project	
VersaSwerve - Static Module	

Quantity

1

Download CAD File from
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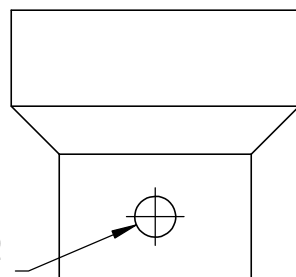
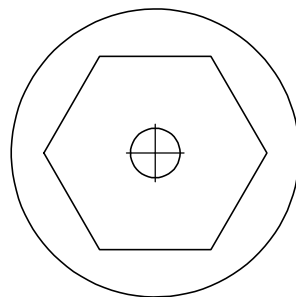


2468

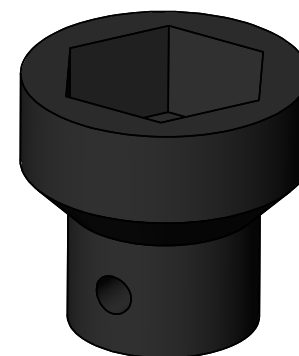
Part Name
Static Module - Steering Encoder Mount
Sub-System/Project
VersaSwerve - Static Module

Quantity
1

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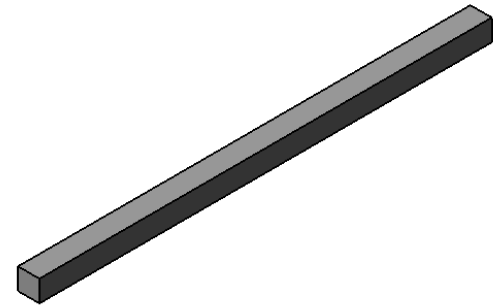
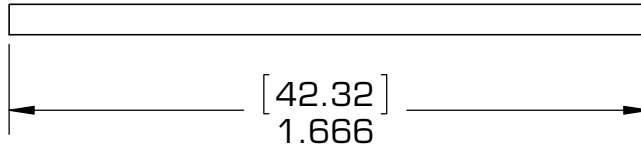
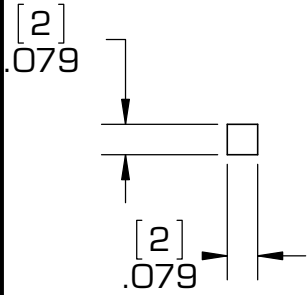
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2468

Part Name	Static Module - Encoder Adapter
Sub-System/Project	VersaSwerve - Static Module
Quantity	1

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2468

Part Name

Static Module - 2mm Key

Sub-System/Project

VersaSwerve - Static Module

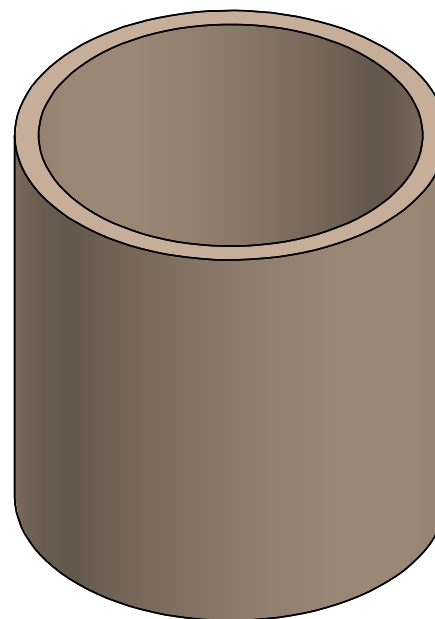
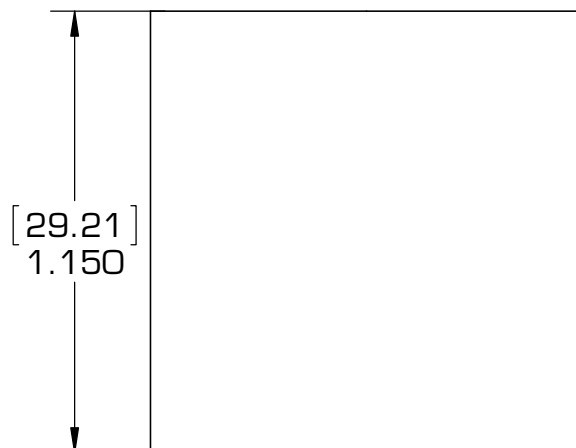
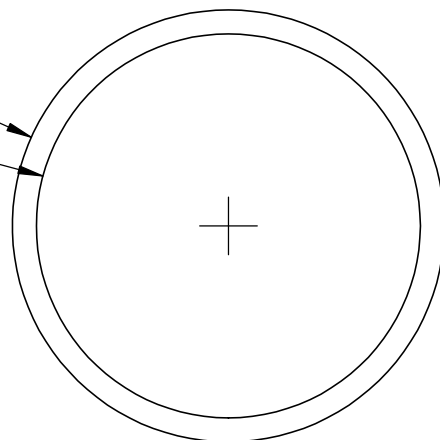
Quantity

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[28.58]
Ø 1.125

[25.40]
Ø 1.000



2468

Part Name

Static Module - Support Bushing

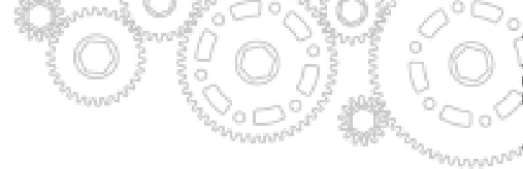
Sub-System/Project

VersaSwerve - Static Module

Quantity

1

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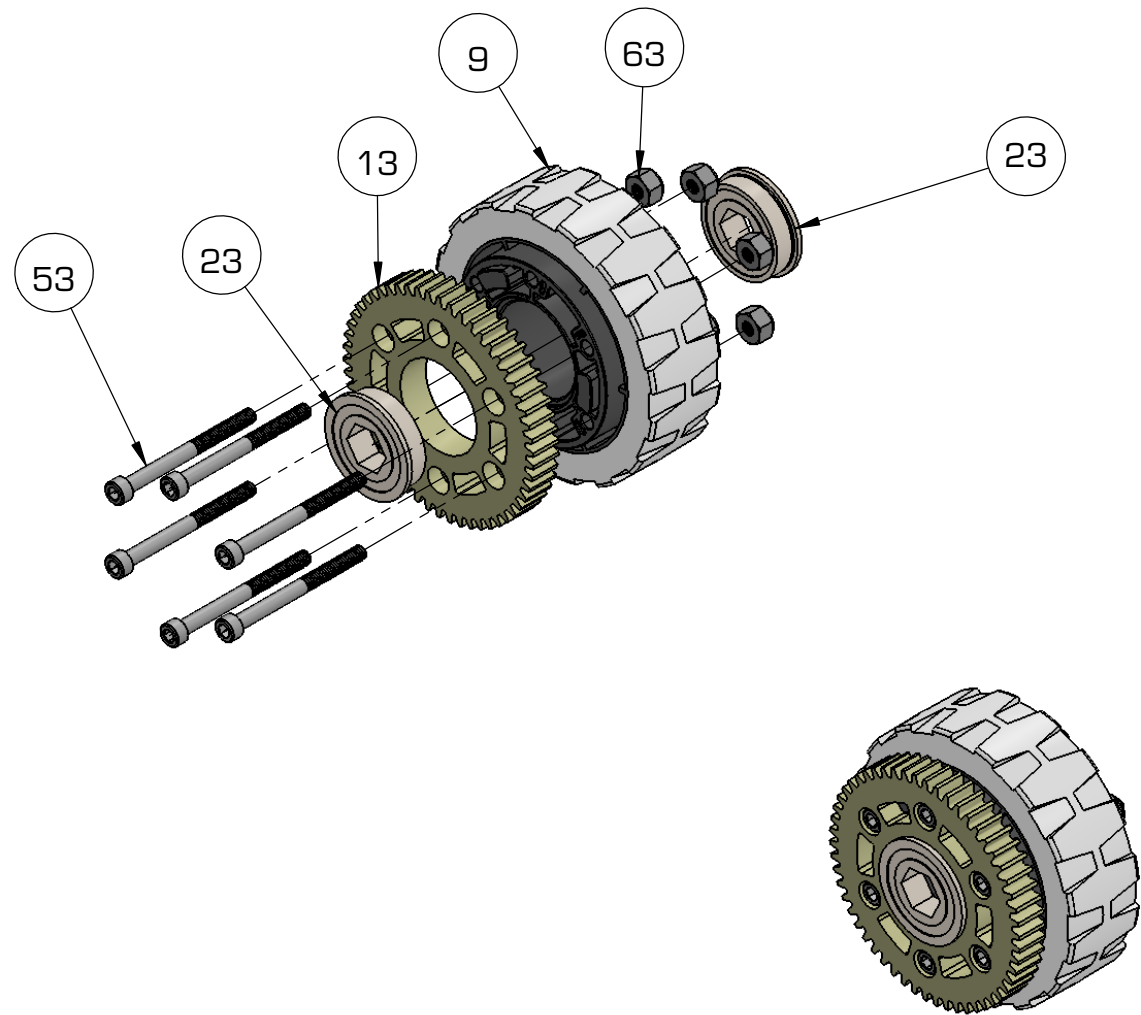
VersaSwerve Drive System

Wheel Module - Wheel Assembly

ITEM NO.	DESCRIPTION	PART NUMBER	QTY.
9	VersaWheel DT (3.25")	217-3202	1
13	54t Gear with 1.125" Bearing Bore & VersaKeys	217-3339	1
23	Flanged Bearing - 0.500in (Hex) x 1.125in x 0.313in v2	217-3875	2
53	Socket Head Screw, #8-32 x 1.875 Long	91251A188	6
63	Nut, Nylock #8-32	90631A009	6

Step 1:

Insert the keys on the VersaWheel DT (3.25") into the keys on the 54t gear. Attach the 54t gear to the VersaWheel hub with six #8-32 screws and nylocks. Insert one of the Flanged Bearings into the gear and the other in the other side of the wheel hub.





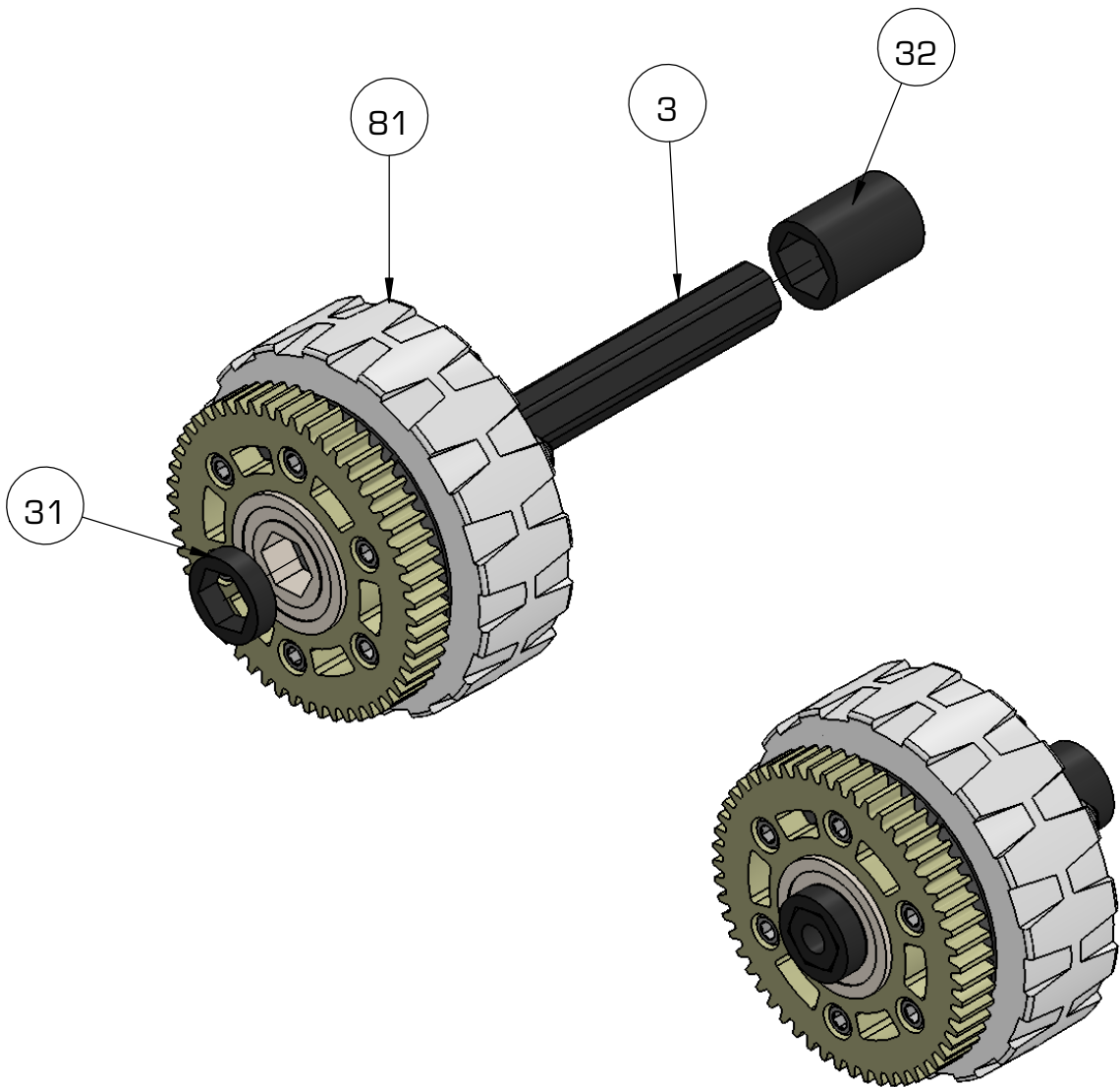
VersaSwerve Drive System

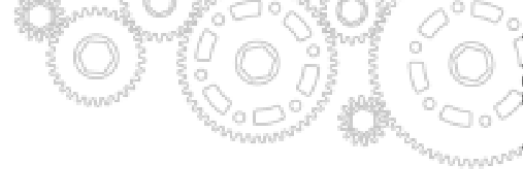
Wheel Module - Lower Axle Assembly

ITEM NO.	DESCRIPTION	PART NUMBER	QTY.
3	Wheel Module - Wheel Axle	From 217-4017	1
31	1/4" Acetal Spacer - 1/2" Hex	217-3259	1
32	1" Acetal Spacer - 1/2" Hex	217-3263	1
81	Wheel Module - Wheel Assembly		1

Step 2:

Slide all components onto the Wheel Axle.





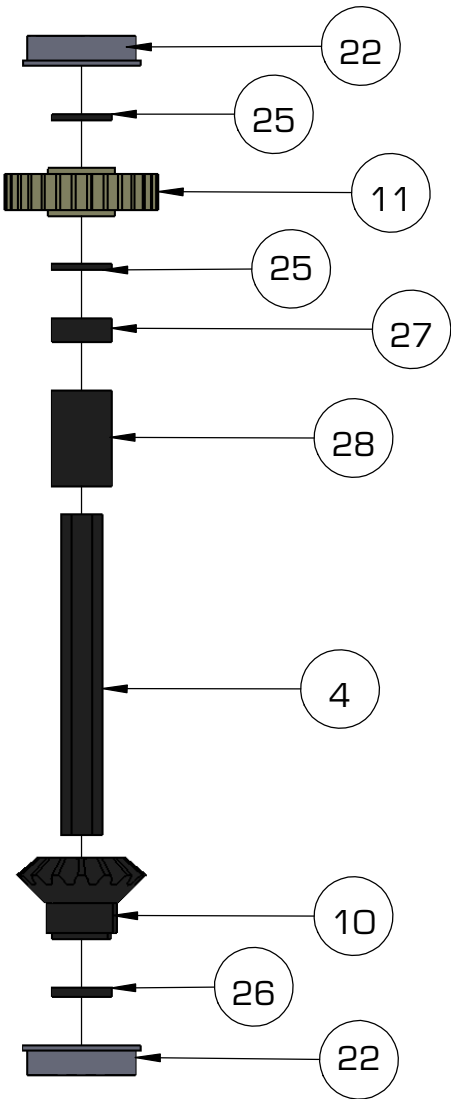
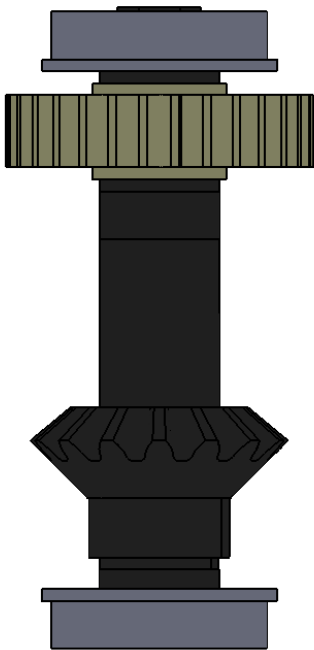
VersaSwerve Drive System

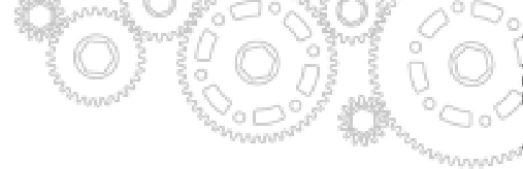
Wheel Module - Upper Axle Assembly

ITEM NO.	DESCRIPTION	PART NUMBER	QTY.
4	Wheel Module - Transfer Shaft	From 217-2754	1
10	15t Bevel Gear with 3/8" Hex Bore	217-3344	1
11	30t Gear with 3/8" Hex Bore	217-3210	1
22	Flanged Bearing - 0.375in (Hex) x 1.125in x 0.313in	217-2735	2
25	1/16" Acetal Spacer - 3/8" Hex	217-3258	2
26	1/8" Acetal Spacer - 3/8" Hex	217-3256	1
27	1/4" Acetal Spacer - 3/8" Hex	217-3260	1
28	1" Acetal Spacer - 3/8" Hex	217-3443	1

Step 3:

Slide all components onto the Transfer Shaft.





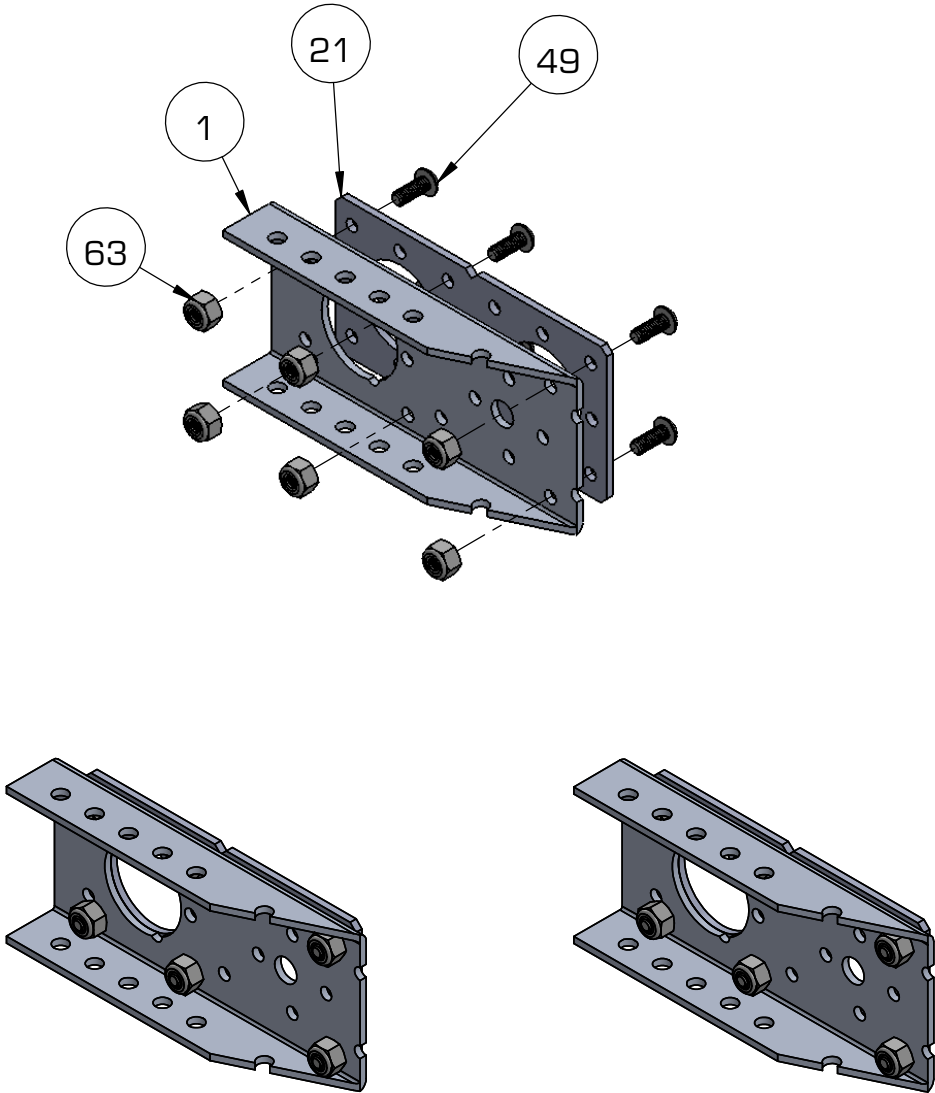
VersaSwerve Drive System

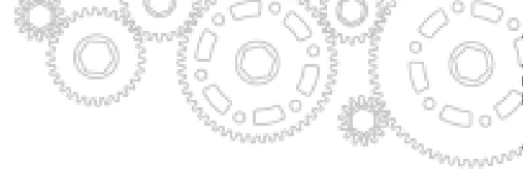
Wheel Module - Sideplate Assembly

ITEM NO.	DESCRIPTION	PART NUMBER	QTY.
1	Wheel Module - Side C-Channel	From 217-4108	2
21	VersaFrame Face Bearing Mount	217-4183	2
49	Button Head Screw, #8-32 x 0.4375 Long	91255A164	12
63	Nut, Nylock #8-32	90631A009	12

Step 4:

Line up the holes of the C-Channel and Bearing Mount, and then attach them with #8-32 button head screws and #8-32 nylocks as shown. Make sure the head of the screw is on the outside of the plate. Assemble two Sideplate Assemblies.





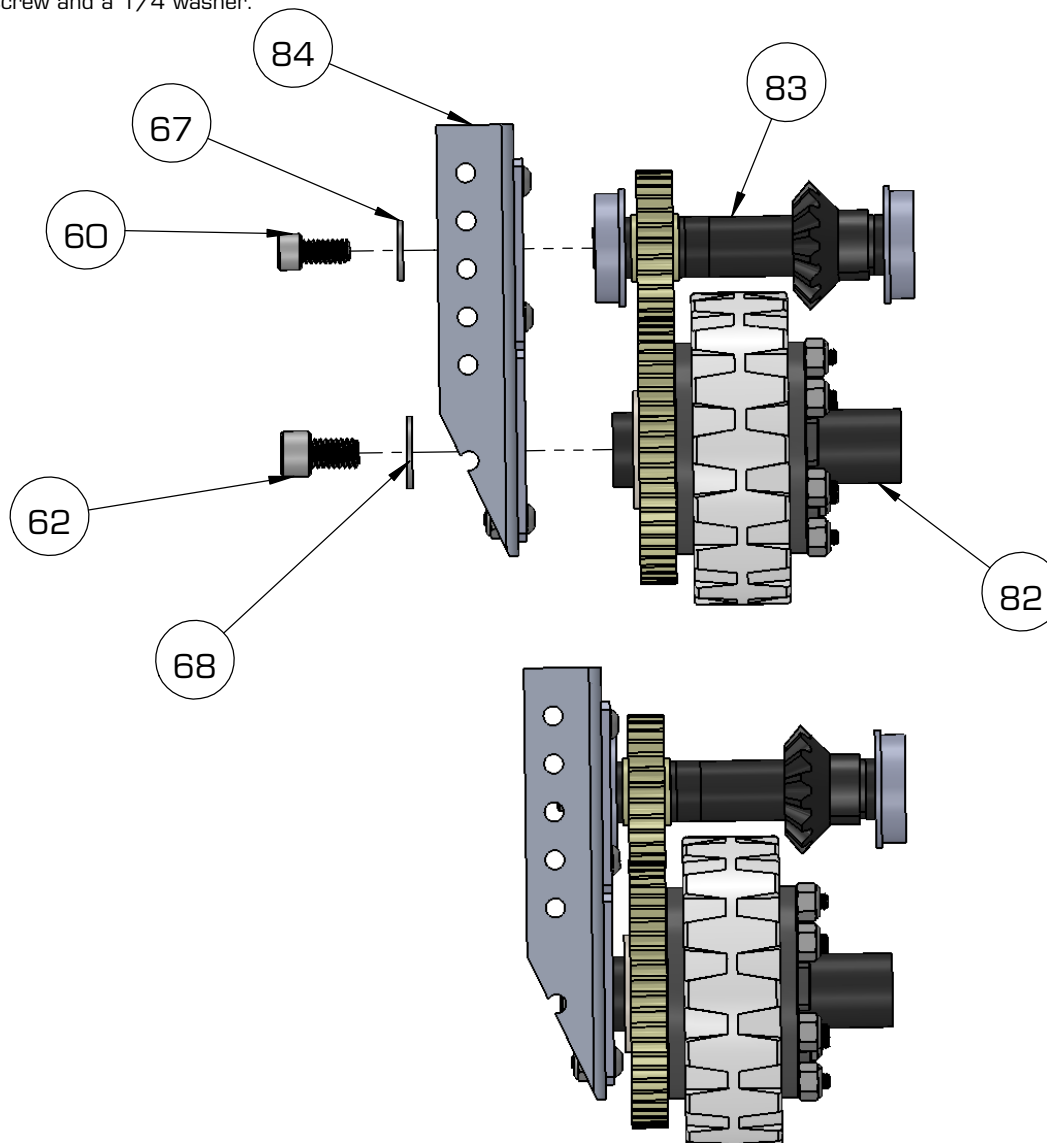
VersaSwerve Drive System

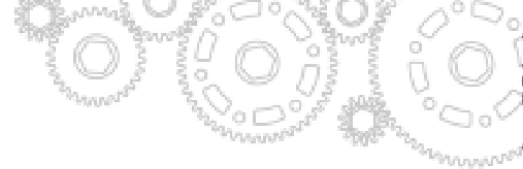
Wheel Module - Lower Side Assembly

ITEM NO.	DESCRIPTION	PART NUMBER	QTY.
60	Socket Head Screw, 1/4-20 x 0.500 Long	91251A537	1
62	Socket Head Screw, 5/16-18 x 0.500 Long	91251A578	1
67	Washer, 1/4	96765A140	1
68	Washer, 5/16	96765A145	1
82	Wheel Module - Lower Axle Assembly		1
83	Wheel Module - Upper Axle Assembly		1
84	Wheel Module - Sideplate Assembly		1

Step 5:

Line up the Lower Axle Assembly and Upper Axle Assembly so the gears mesh. Then place one Sideplate Assembly on top, sliding the bearing into the bearing hole. Fasten the plate to the axles with the washers and screws. The lower 0.5in axle requires a 5/16-18 socket head screw and a 5/16 washer, while the upper 0.375in axle requires a 1/4-20 socket head screw and a 1/4 washer.





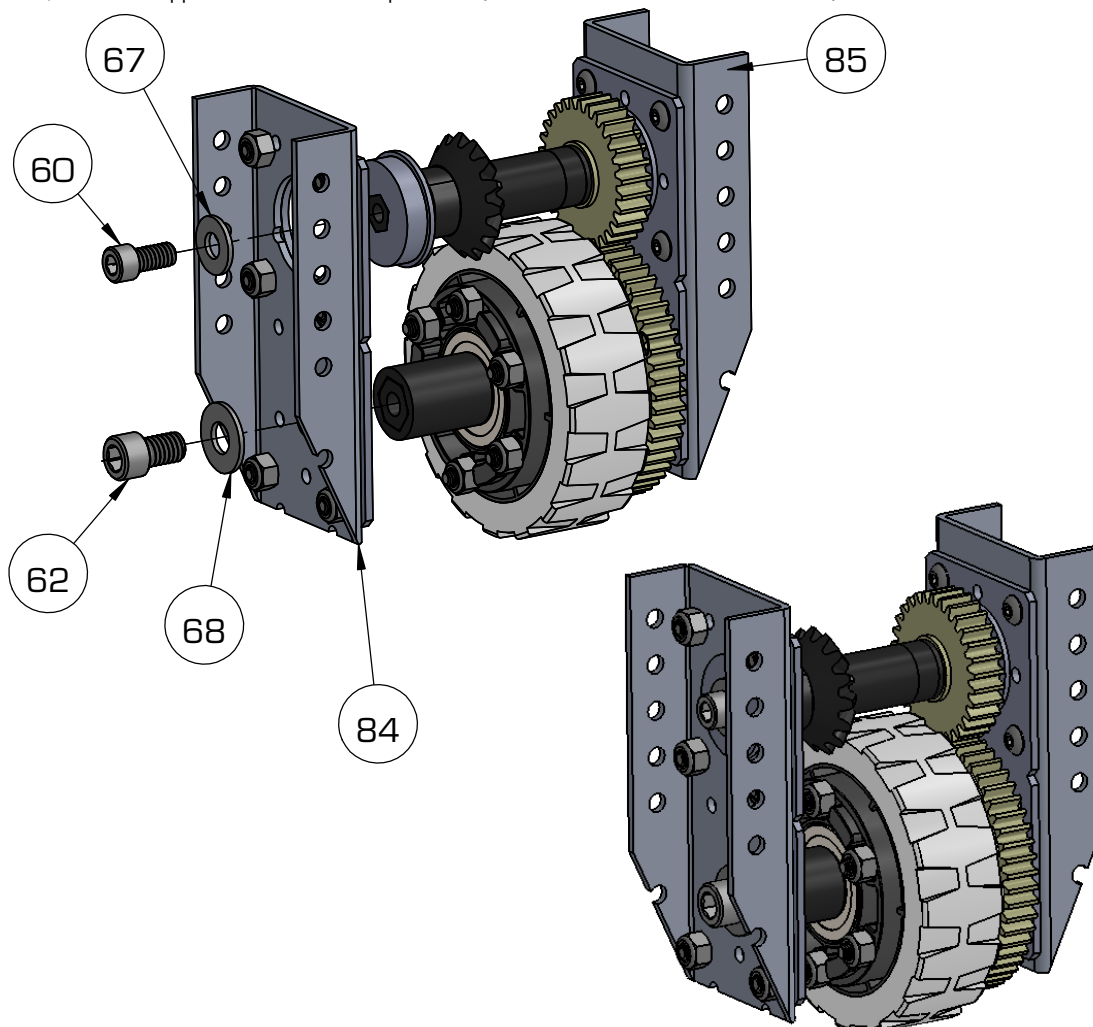
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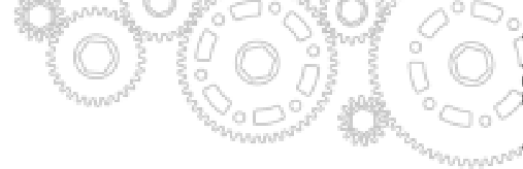
Wheel Module - Upper Assembly

ITEM NO.	DESCRIPTION	PART NUMBER	QTY.
60	Socket Head Screw, 1/4-20 x 0.500 Long	91251A537	1
62	Socket Head Screw, 5/16-18 x 0.500 Long	91251A578	1
67	Washer, 1/4	96765A140	1
68	Washer, 5/16	96765A145	1
84	Wheel Module - Sideplate Assembly		1
85	Wheel Module - Lower Side Assembly		1

Step 6:

Align the Sideplate Assembly with the axles of the Lower Side Assembly and slide the bearing into the bearing hole. Fasten the plate to the axles with the washers and screws. The lower 0.5in axle requires a 5/16-18 socket head screw and a 5/16 washer, while the upper 0.375in axle requires a 1/4-20 socket head screw and a 1/4 washer.





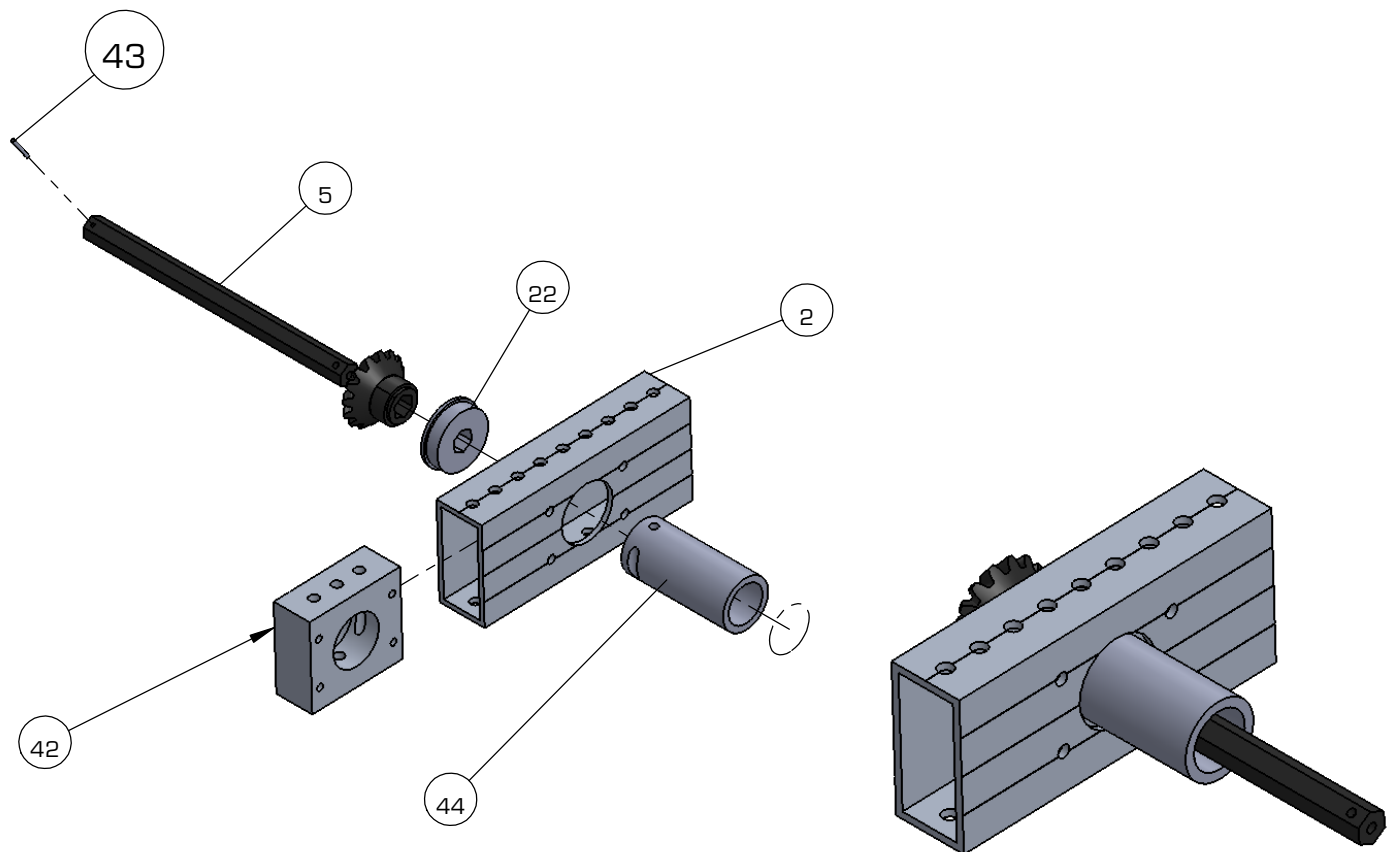
VersaSwerve Drive System

Wheel Module - Upper Assembly

ITEM NO.	DESCRIPTION	PART NUMBER	QTY.
2	Wheel Module - Top 1x2in Channel	From 217-3453	1
5	Wheel Module - Input Shaft	From 217-2754	1
10	15t Bevel Gear with 3/8" Hex Bore	217-3344	1
22	Flanged Bearing - 0.375in (Hex) x 1.125in x 0.313in	217-2735	1
42	Wheel Module - Support Block	From 8975K237	1
43	Wheel Module - Shaft Stopper Pin	From 98381A420	1
44	Wheel Module - Support Tube	From 9056K36	1

Step 7:

First, slide the Support Block into the Top 1x2in Channel and insert the bearing. Then, insert the Shaft Stopper Pin into the hole in the axle. Slide the axle through the 15t bevel gear and the 0.375in hex flanged bearing. Insert the Support Tube as well, although this will not be fastened until later.





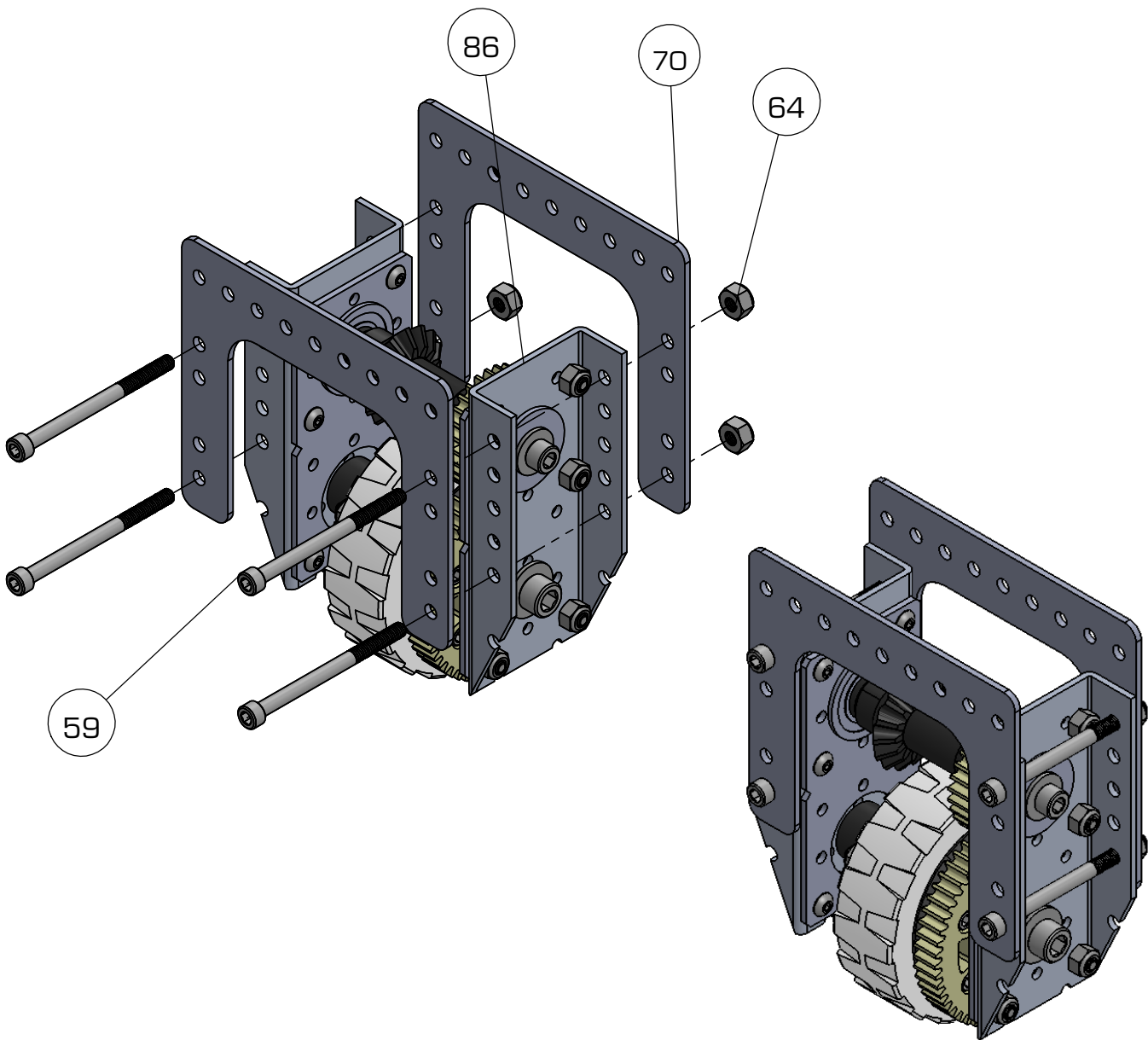
VersaSwerve Drive System

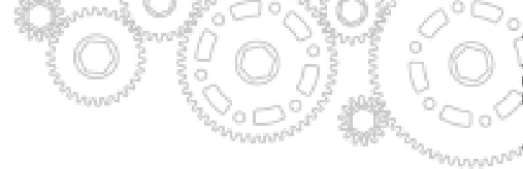
Wheel Module - U Gusset Attachment

ITEM NO.	DESCRIPTION	PART NUMBER	QTY.
59	Socket Head Screw, #10-32 x 2.500 Long	91251A355	4
64	Nut, Nylock #10-32	90631A411	4
70	Wheel Module - Custom U-Gusset	0.090" Thick Sheet Metal	2
86	Lower Assembly		1

Step 8:

Line up the U gussets with the holes on the sideplates, then fasten them using the nuts and screws.





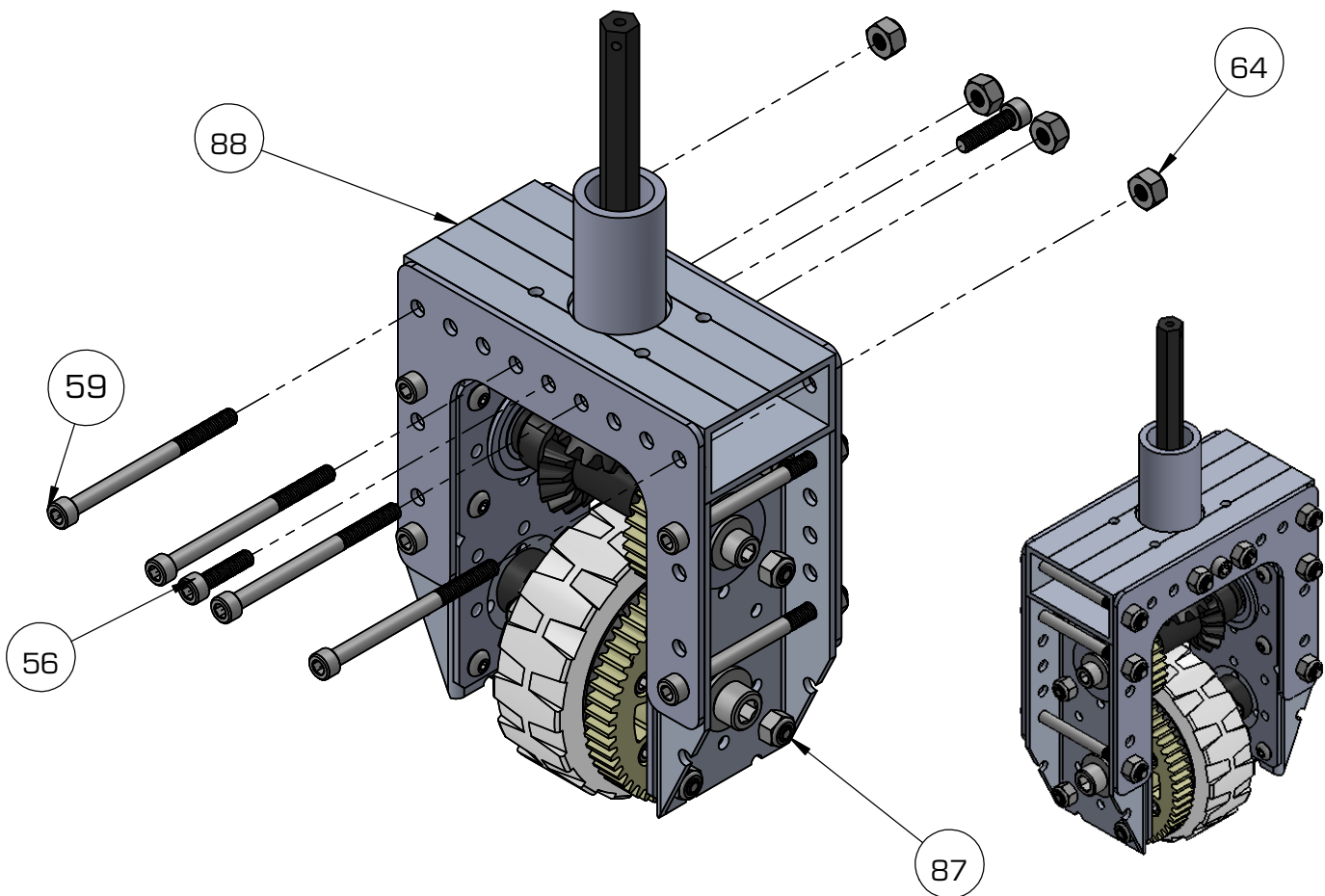
VersaSwerve Drive System

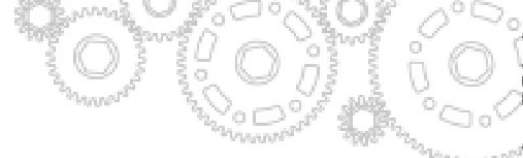
Wheel Module - Pod Assembly

ITEM NO.	DESCRIPTION	PART NUMBER	QTY.
56	Socket Head Screw, #10-32 x 0.750 Long	91251A345	2
59	Socket Head Screw, #10-32 x 2.500 Long	91251A355	4
64	Nut, Nylock #10-32	90631A411	4
87	Lower Assembly with U Gusset		1
88	Upper Assembly		1

Step 9:

Slide the upper assembly into the lower assembly, meshing the bevel gears. Attach the upper assembly to the U gussets with nuts and bolts. Take care to align the holes in the support tube with the screws. There are two screws without nuts that screw into the block.





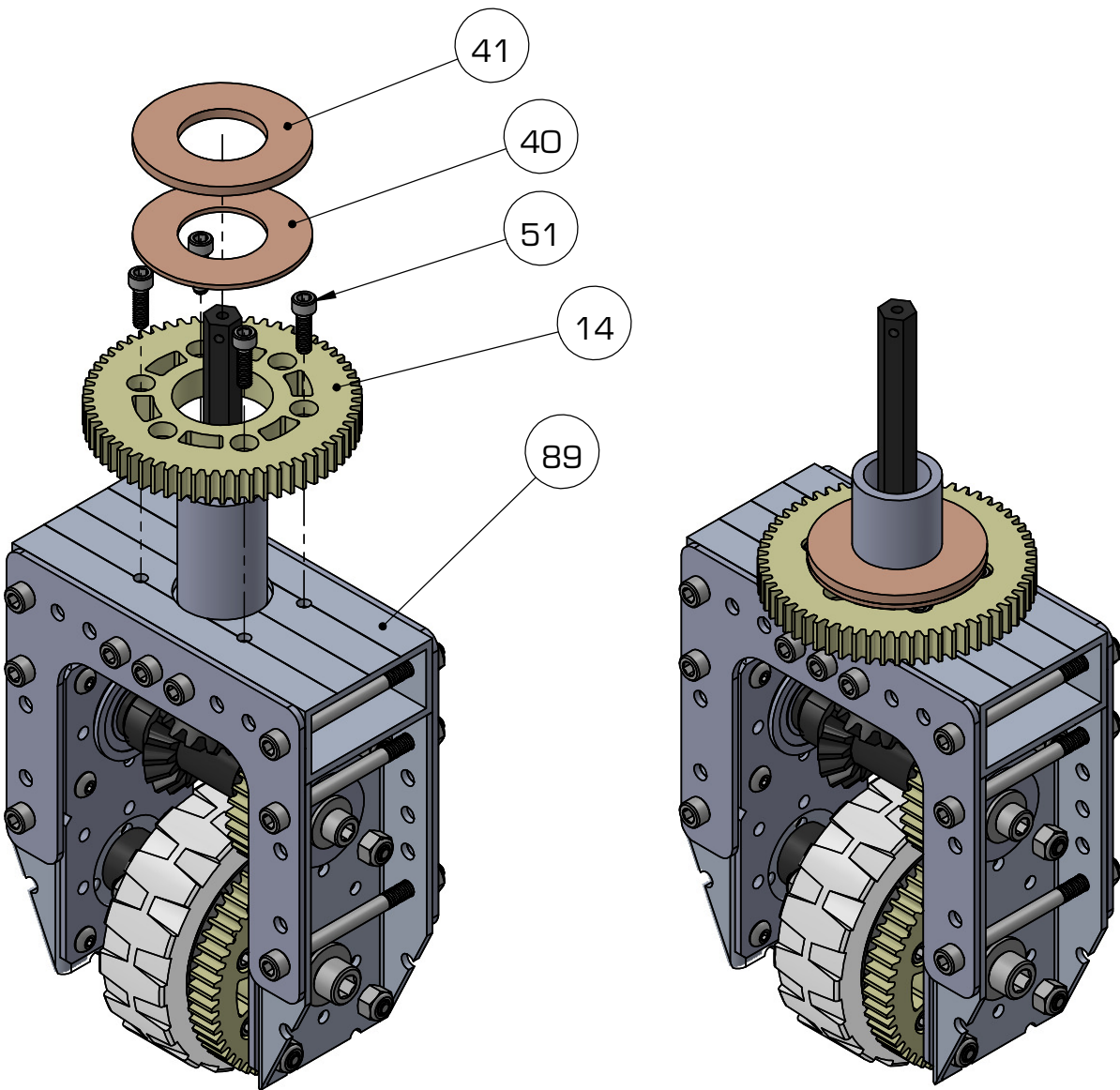
VersaSwerve Drive System

Wheel Module Assembly

ITEM NO.	DESCRIPTION	PART NUMBER	QTY.
14	60t Gear with 1.125" Bearing Bore & VersaKeys	217-3342	1
40	Wheel Module - Thin Thrust Bearing	From 7814K36	1
41	Multipurpose 2" OD, 1" ID, 1/8" Thick Thrust Bearing	7814K36	1
51	Socket Head Screw, #8-32 x 0.5625 Long	91251A280	4
89	Wheel Module - Pod		1

Step 10:

Attach the 60t Gear with 1.125" Bearing Bore to the Pod using four #8-32 screws. Slide on the Thin Thrust bearing and the thrust bearing on top



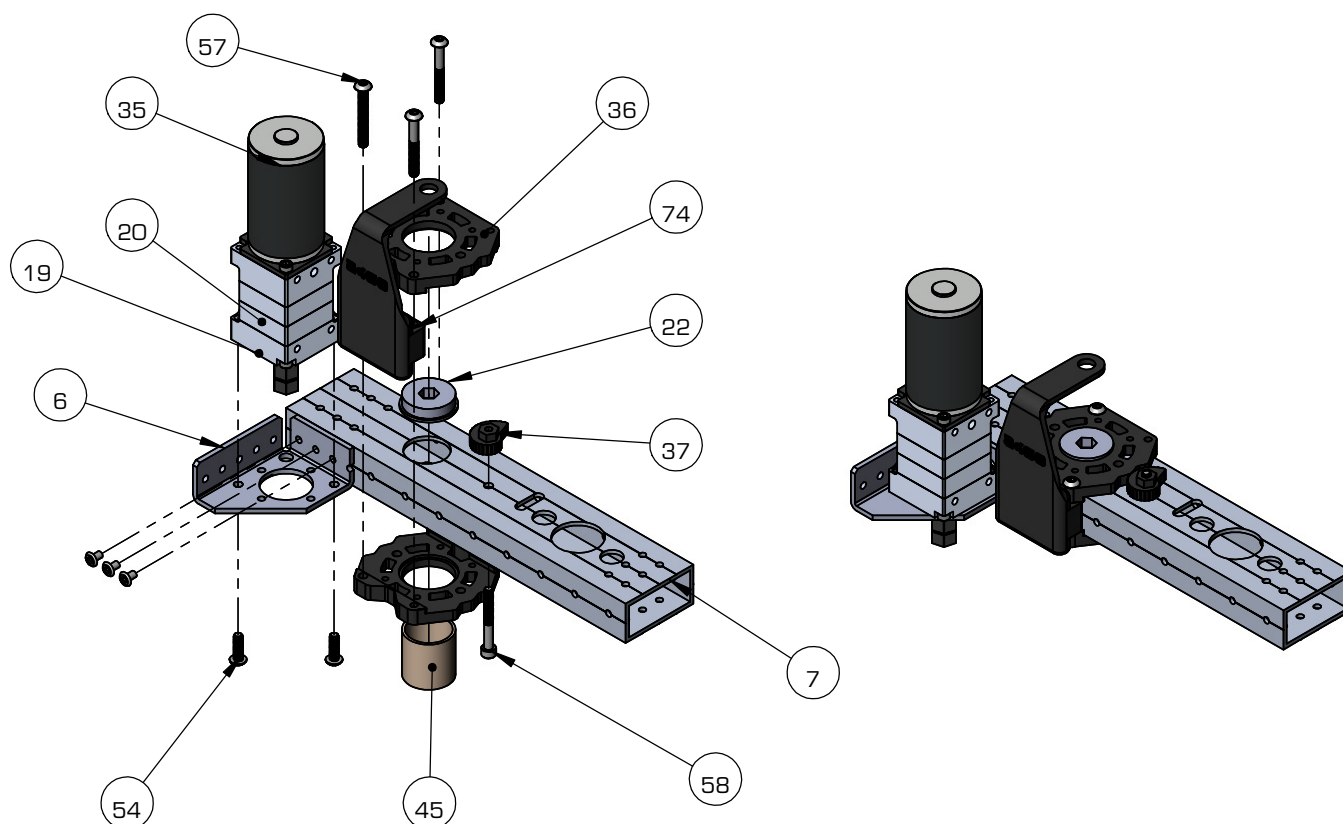
VersaSwerve Drive System

Static Module - Base

ITEM NO.	DESCRIPTION	PART NUMBER	QTY.
6	Static Module - Cutdown Corner Gusset	From 217-4238	1
7	Static Module - Housing 1x2in Channel	From 217-3453	1
19	Base VersaPlanetary 1:1 <with Cutdown 1/2" Hex Output>	217-3563	1
20	VersaPlanetary 10:1 Gear Kit with Ring Gear	217-3570	2
22	Flanged Bearing - 0.375in (Hex) x 1.125in x 0.313in	217-2735	1
35	BAG Motor	217-3351	1
36	VersaBlock Kit	217-3432	1
37	WCP Cam	217-3431	1
45	Static Module - Support Bushing	From 6381K18	1
54	Button Head Screw, #10-32 x 0.625 Long	91255A267	2
57	Button Head Screw, #10-32 x 1.500 Long Full Thread	91306A277	1
58	Socket Head Screw, #10-32 x 1.500 Long	90044A118	1
74	Drive Encoder Mount	3D Printed	1

Step 11:

Attach the cutdown corner gusset with 5/32" pop rivets, then fasten the 100:1gear ratio VersaPlanetary Gearbox with the cutdown 1/2" output shaft (instructions on assembling VersaPlanetary Gearboxes can be found on vexpro.com) using #10-32 screws. Assemble the VersaBlock with the 3D printed Drive Encoder Mount using three #10-32 screws around the Housing 1x2in Channel. Slide in the bushing from the bottom of the Versablock assembly.





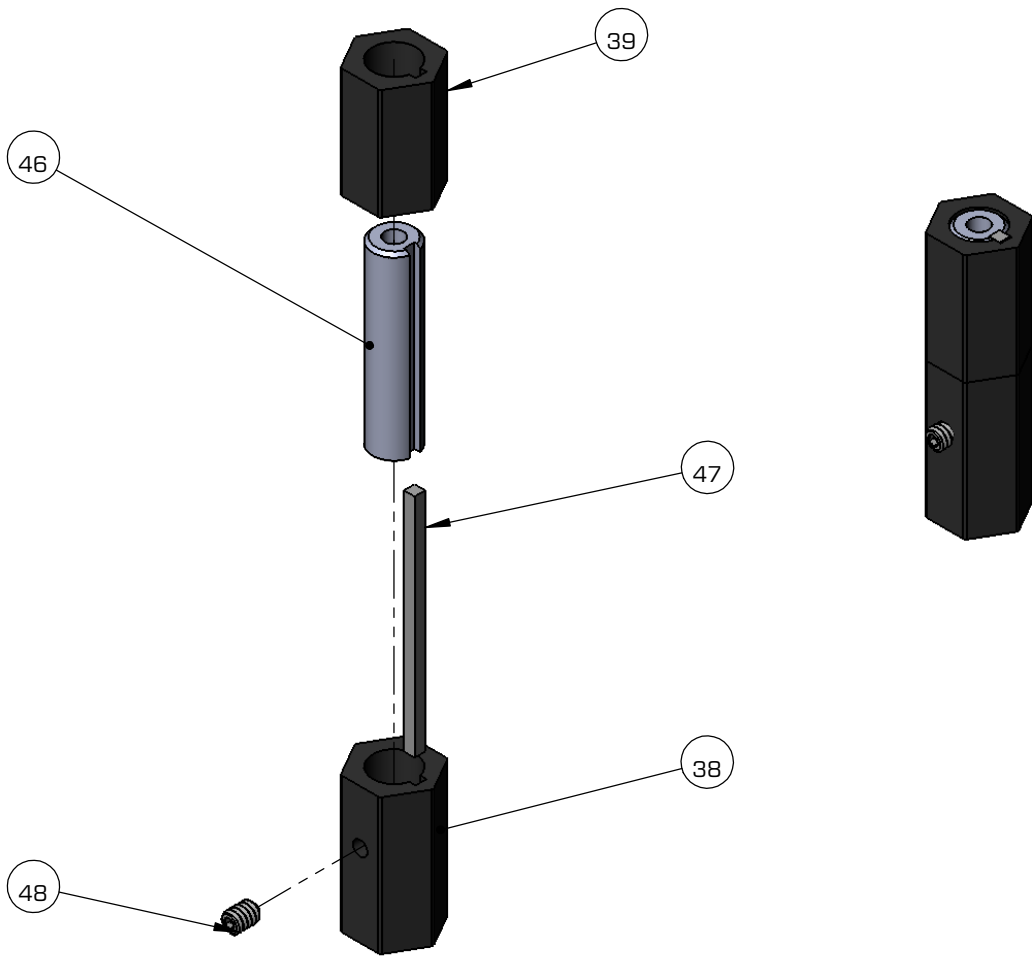
VersaSwerve Drive System

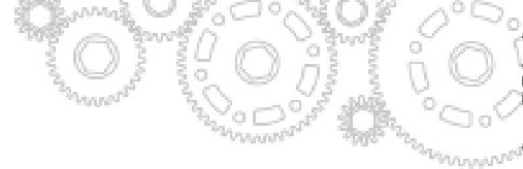
Static Module - Adapter Shaft

ITEM NO.	DESCRIPTIONS	PART NUMBER	QTY.
38	Static Module - Long 8mm to 1/2" Hex Adapter	From 217-3255	1
39	Static Module - Cutdown 8mm to 1/2" Hex Adapter	From 217-3255	1
46	Static Module - Drive InnerShaft	From 1439K211	1
47	Static Module - 2mm Key	From 92288A710	1
48	Set Screw, #6-32 x 0.1875 Long	92313A143	1

Step 12:

Apply strong adhesive on the curved surface of the 8mm shaft. Assemble components as shown and wipe off excess adhesive.





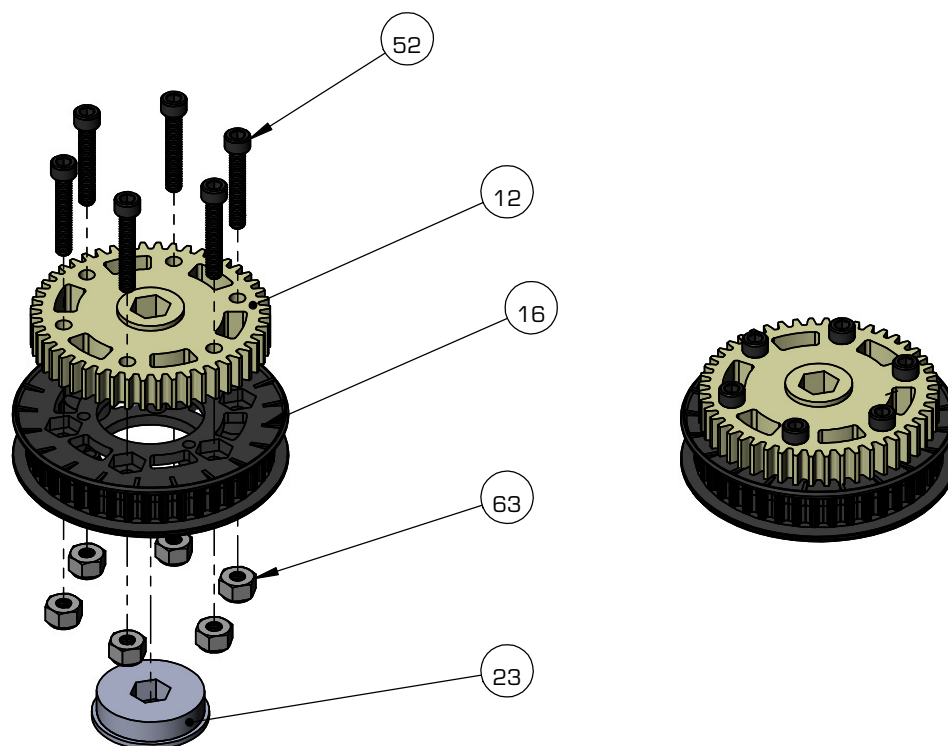
VersaSwerve Drive System

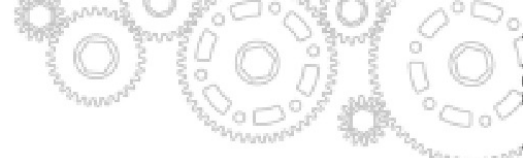
Static Module - Pulley Assembly

ITEM NO.	DESCRIPTION	PART NUMBER	QTY.
12	48t Gear with 3/8" Hex & VersaKeys	217-3217	1
16	VersaPulley Kit (HTD 5mm) - 42T, 18mm wide	217-3199	1
23	Flanged Bearing - 0.500in (Hex) x 1.125in x 0.313in v2	217-3875	1
52	Socket Head Screw, #8-32 x 1.000 Long	91251A199	6
63	Nut, Nylock #8-32	90631A009	6

Step 13:

Attach the 48t Gear with VersaKey pattern to the pulley with six #8-32 screws and nylocks. Insert a 3/8" Hex bearing in the bottom of the pulley.





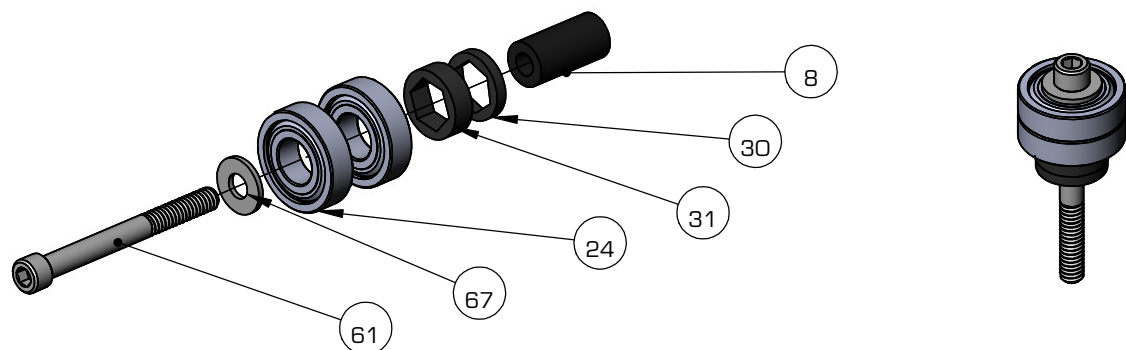
VersaSwerve Drive System

Static Module - Tensioner Assembly

ITEM NO.	DESCRIPTION	PART NUMBER	QTY.
8	Static Module - Tensioner Standoff	From 217-2762	1
24	Radial Bearing - 0.500in x 1.125in x 0.313in	217-3109	2
30	1/8" Acetal Spacer - 1/2" Hex	217-2758	1
31	1/4" Acetal Spacer - 1/2" Hex	217-3259	1
61	Socket Head Screw, 1/4-20 x 2.500 Long	91251A552	1
67	Washer, 1/4	96765A140	1

Step 14:

Assemble components along a single axis with the 1/4-20 screw through all.

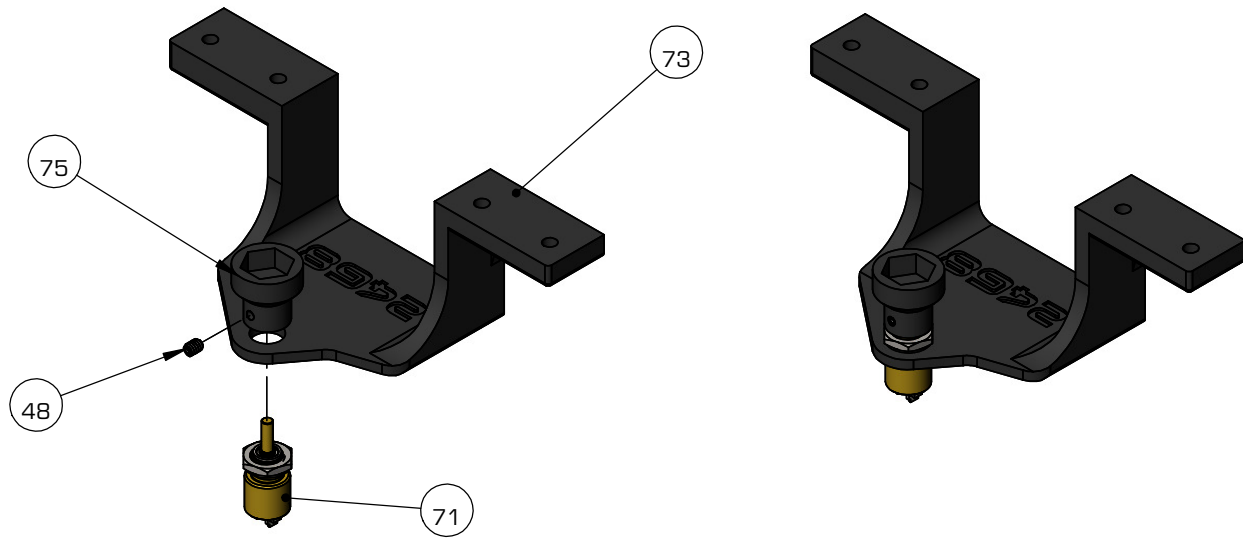


Static Module - Steering Encoder Mount Assembly

ITEM NO.	DESCRIPTION	PART NUMBER	QTY.
48	Set Screw, #6-32 x 0.1875 Long	92313A143	1
71	MA3 Encoder	MA3-A10-125-N	1
73	Steering Encoder Mount	3D Printed	1
75	Encoder Adapter	3D Printed	1

Step 15:

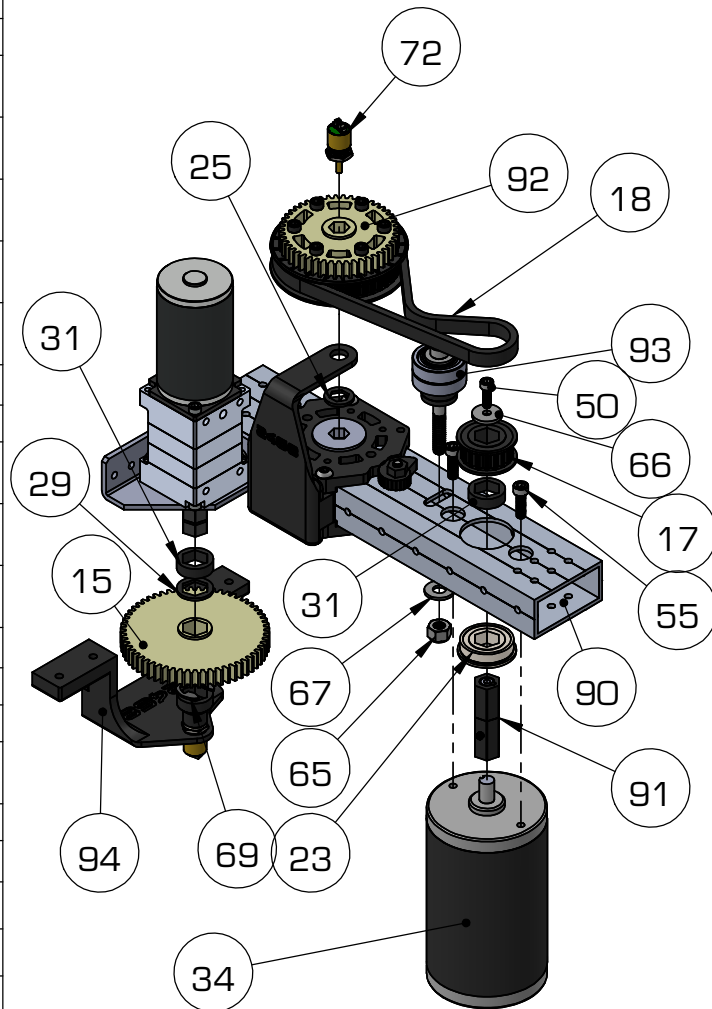
Attach the encoder to the 3D printed Steering Encoder Mount. Slide the Encoder Adapter on the encoder shaft and secure with a #6-32 set screw.



VersaSwerve Drive System

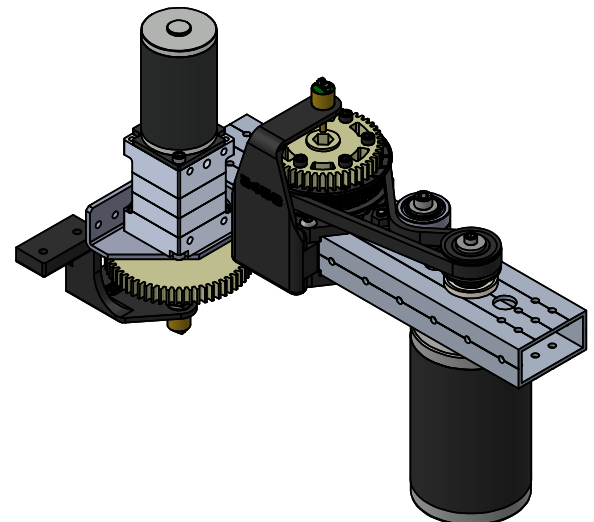
Static Module Assembly

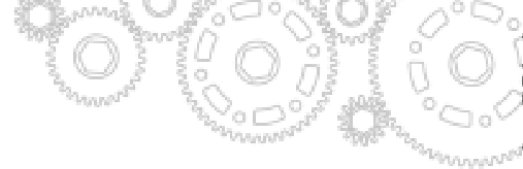
ITEM NO.	DESCRIPTION	PART NUMBER	QTY.
15	60t Gear with 1/2" Hex Bore	217-3574	1
17	Timing Pulley (HTD 5mm) - 18T, 9mm Double Flange	217-3225	1
18	Timing Belt (HTD 5mm) - 80T, 9mm Wide	217-3456	1
23	Flanged Bearing - 0.500in (Hex) x 1.125in x 0.313in v2	217-3875	1
25	1/16" Acetal Spacer - 3/8" Hex	217-3258	1
29	1/16" Acetal Spacer - 1/2" Hex	217-3257	1
31	1/4" Acetal Spacer - 1/2" Hex	217-3259	2
34	CIM Motor with Cutdown Shaft	From 217-2000	1
48	Set Screw, #6-32 x 0.1875 Long	92313A143	1
50	Socket Head Screw, #8-32 x 0.500 Long	91251A194	1
55	Socket Head Screw, #10-32 x 0.625 Long	91251A344	1
65	Nut, Nylock 1/4-20	97135A210	1
66	Washer, Oversized #8	90377A118	1
67	Washer, 1/4	96765A140	1
69	Retaining Ring (E-Style), 0.500 Shaft Size	97431A340	1
72	MA3 Encoder	MA3-A10-125-B	1
90	Static Module - Base		1
91	Static Module - Adapter Shaft		1
92	Static Module - Pulley Assembly		1
93	Static Module - Tensioner Assembly		1
94	Static Module - Steering Encoder Mount Assembly		1



Step 16:

Insert 1/2" hex bearing in the Housing 1x2" Channel as shown. Install the Adapter Shaft through the bearing and assemble the 18t Pulley and other components around the shaft. Attach CIM motor with the two #10-32 screws. Insert the Tensioner assembly in the appropriate slot and tighten in place using a 1/4-20 washer and nylock. Place the Pulley Assembly on top of the VersaBlock with the 1/16" thick 3/8" Hex Acetal Spacer under it. Run the timing belt around the two pulleys and the Tensioner pulleys. Attach the appropriate spacers and the gear on the output shaft of the VersaPlanetary and lock in place with a spring clip. Attach the Steering Encoder Mount Assembly on the end of the VersaPlanetary output shaft. Attach the encoder on the Drive Encoder Mount.





VersaSwerve Drive System

VersaSwerve Assembly

ITEM NO.	DESCRIPTION	PART NUMBER	QTY.
33	Clamping Shaft Collar - 3/8" Hex ID	217-2739	1
48	Set Screw, #6-32 x 0.1875 Long	92313A143	1
95	Static Module Assembly		1
96	Wheel Module Assembly		1

Step 18:

Slide in the Wheel Module assembly through the VersaBlock of the Static Module. Clamp the top of the 3/8" Input shaft using a Clamping Shaft Collar and install a #6-32 set screw for the drive encoder.

